

Long Lake and Kinosis Oil Sands Project Scheme Approval 9485, as amended

Annual Performance Presentation

This presentation contains information comply with Alberta Energy Regulator's Directive 054 – Performance Presentations, Auditing, and Surveillance of In Situ Oil Sands Schemes

June 30, 2021



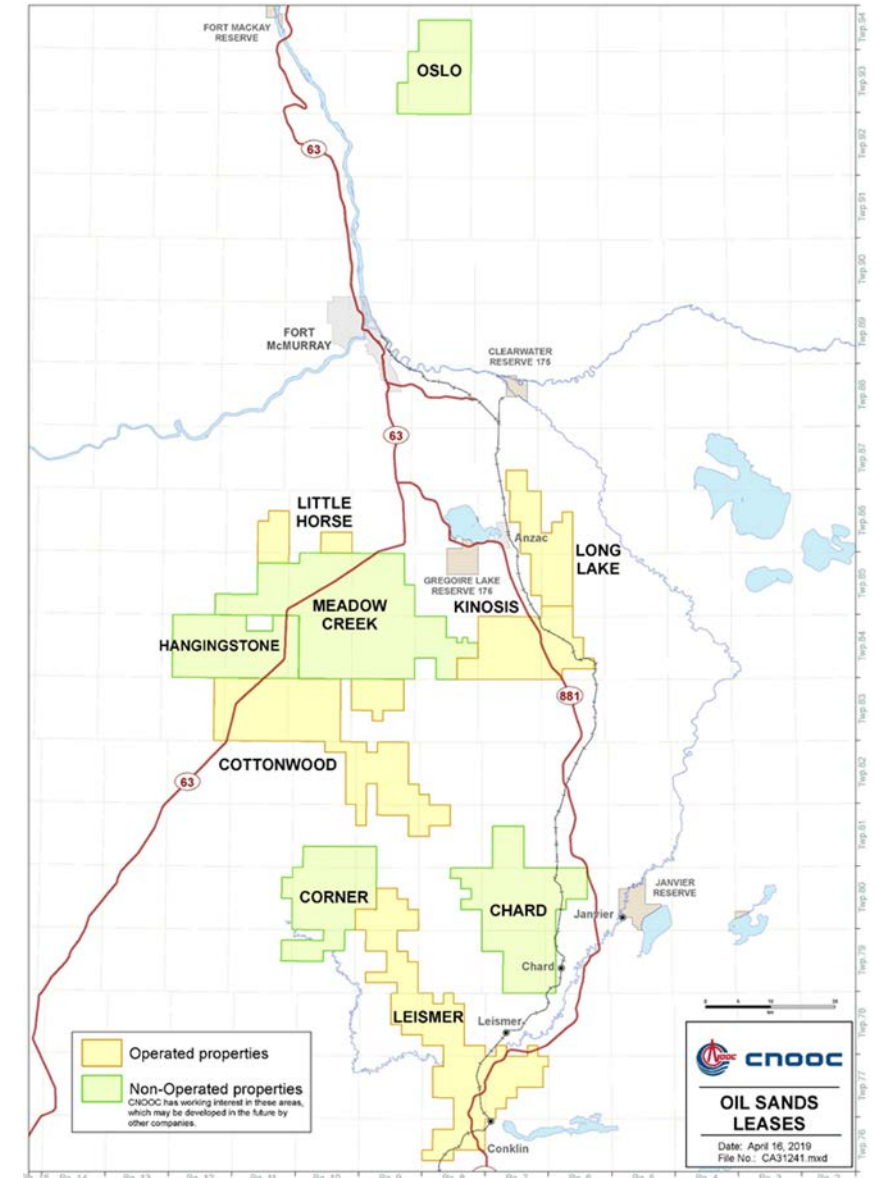
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- 
- A large-scale industrial facility, likely an oil or gas processing plant, is shown in the background. The image features several tall, cylindrical towers with yellow safety railings and ladders. A complex network of white pipes and metal structures is visible. In the foreground, there are more pipes, valves, and a blue signpost with an upward arrow. The sky is clear and blue.



Section 1 - Introduction



- CNOOC Petroleum North America ULC (formerly Nexen Energy ULC) (“CPNA”) is an upstream oil and gas company responsibly developing energy resources in North America.
- CPNA is a wholly-owned subsidiary of the China National Offshore Oil Company Limited (CNOOC).



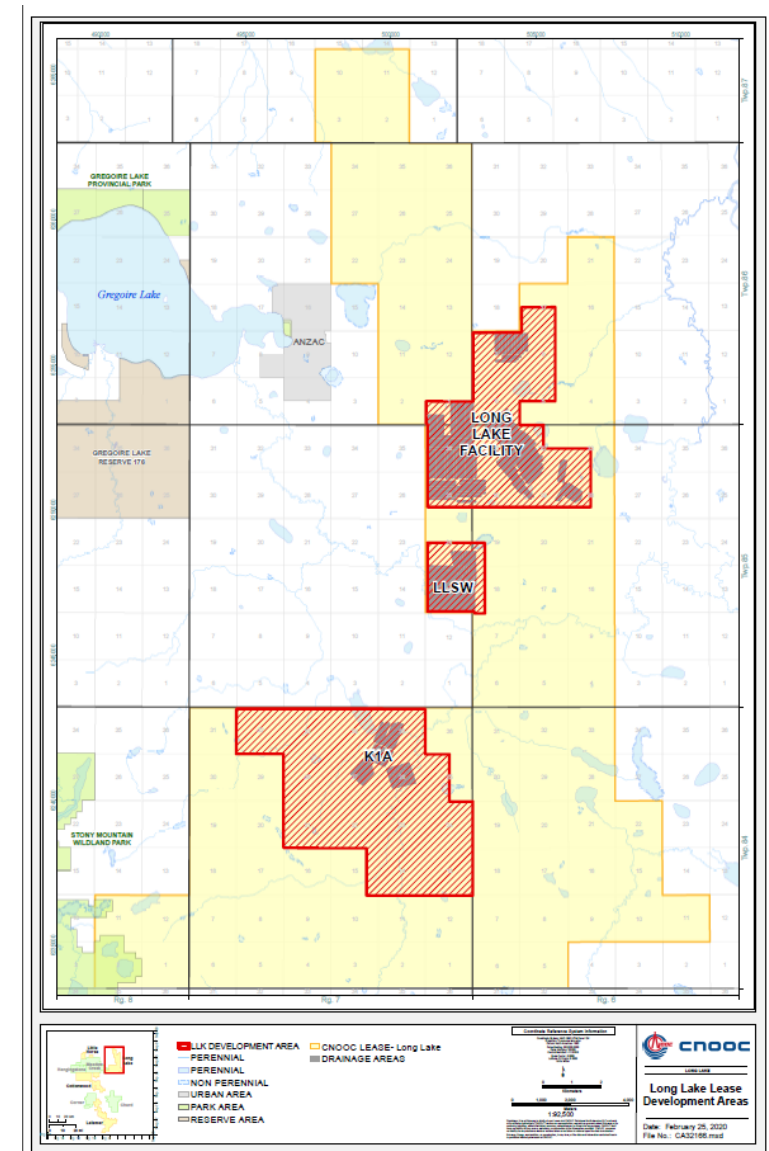
Long Lake Scheme Description

- Located approximately 40 km southeast of Fort McMurray.
- An integrated SAGD and Upgrader oil sands project producing from the Wabiskaw-McMurray deposit.

	Design (LLK)	
	m ³ /d	bb/d
Bitumen	11,130	70,000
Steam	37,000	233,000
SOR	3.3	

	Design (K1A*)	
	m ³ /d	bb/d
Bitumen	3,180	20,000
Steam	9,540	60,000
SOR	3.0	

*K1A – First 20K of 70K which is Phase 1A of Kinosis



Long Lake Scheme History

Year	Activity
2000	EIA and regulatory submissions for the commercial Long Lake Facility (LLK)
2003	Regulatory approvals for the commercial LLK Facility
2003 - 2007	Production at the Long Lake SAGD Pilot Plant
2004	Construction begins for the commercial LLK Facility
2007	Start of commercial bitumen production for the Long Lake Facility
2007	Regulatory submissions for Long Lake South (development of Kinosis lease)
2009	Regulatory approvals issued for Kinosis Project (formerly Long Lake South)
2009	Start of operation of the LLK Upgrader
2012	Major turnaround for maintenance at Central Processing Facility (CPF) and Upgrader
2012	Regulatory approvals and construction begins for Pads 14, 15 and K1A Pads 1 and 2
2013	Increased production from LLK well pads, begin circulation at Pad 14
2014	K1A Pads 1, 2 and Pads 14, 15 start production
2015	Diluent Recovery Project start up; Pipeline leak ceases production at K1A; 7N Infills on production
2016	Hydro-Cracker Unit (HCU) Incident; Wildfire shut down Long Lake operations for ~2 months
2017	Commenced drilling infills on Pads 5 and 8
2018	Pads 5, 8 Infills on production; Drilling commenced on Pad 3,6 Infills & LLSW SAGD well pairs
2019	Pad 1,3,5,6,13 Infills on production; D&C completed on LLSW SAGD well pairs
2020	Completed construction of Long Lake South West (LLSW) sustaining pads

- Long Lake pads exhibited strong production prior to plant turnaround
- Successful major plant turnaround at Long Lake from May to June 2020
- Managed startup and ramp up throughout last half of 2020
- Completed construction of Long Lake South West (LLSW) sustaining pads
- K1A Recovery Project
 - Continued progress on detailed engineering for pipeline replacements
 - Commenced facility restart inspections

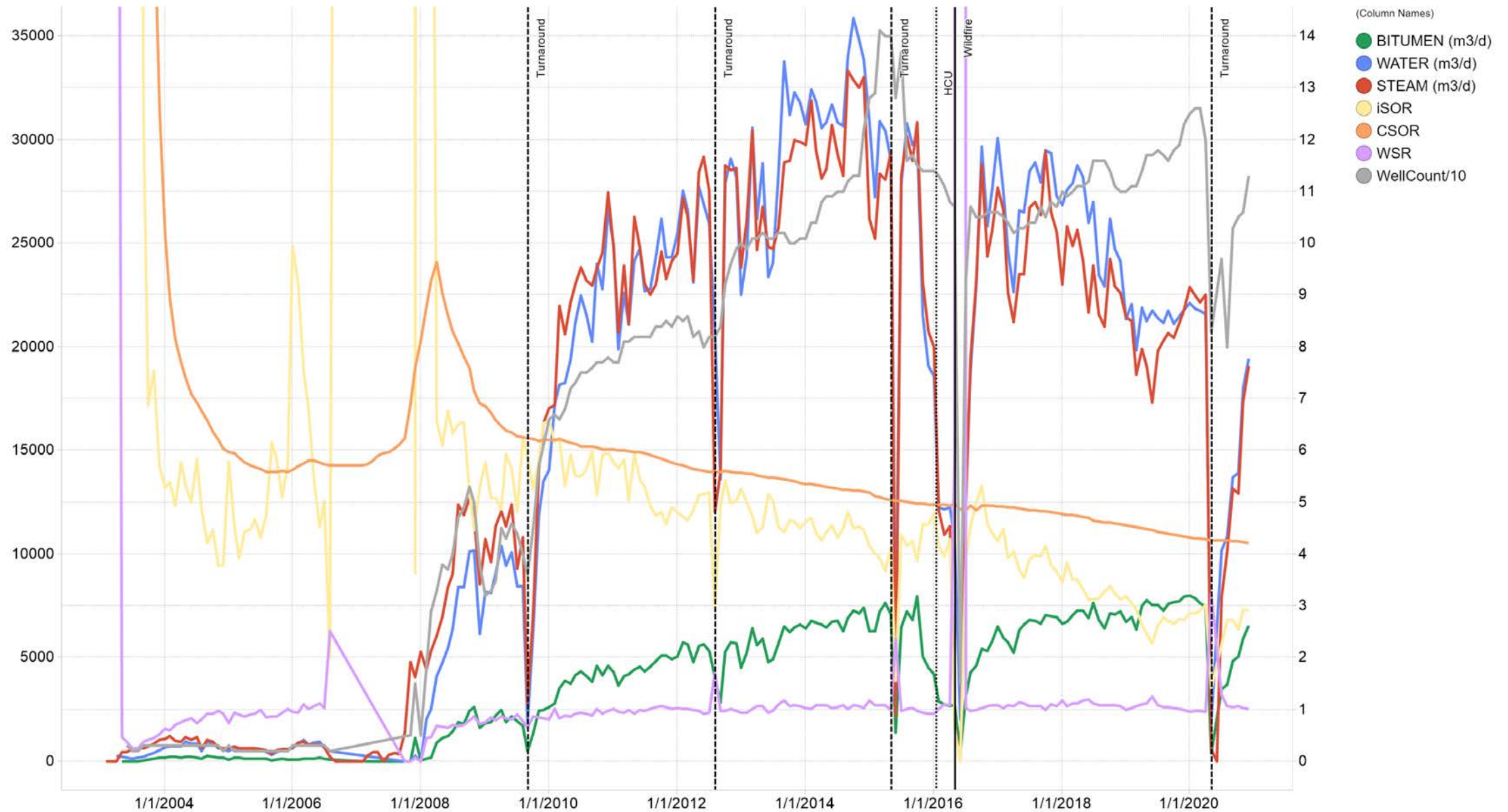


Sections 2 to 7- Subsurface



Section 2 – Scheme Performance

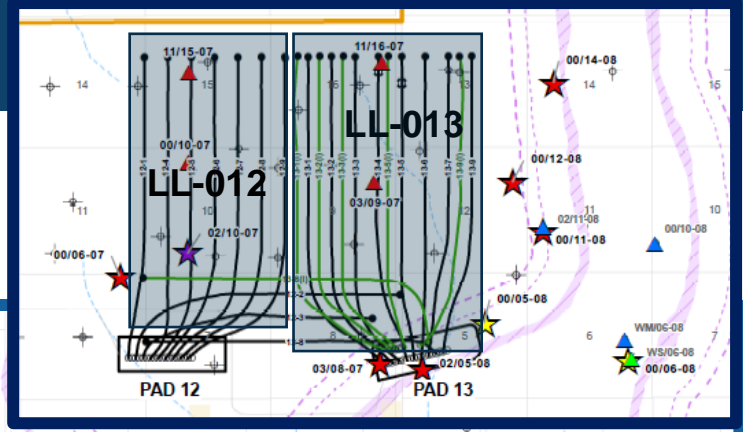
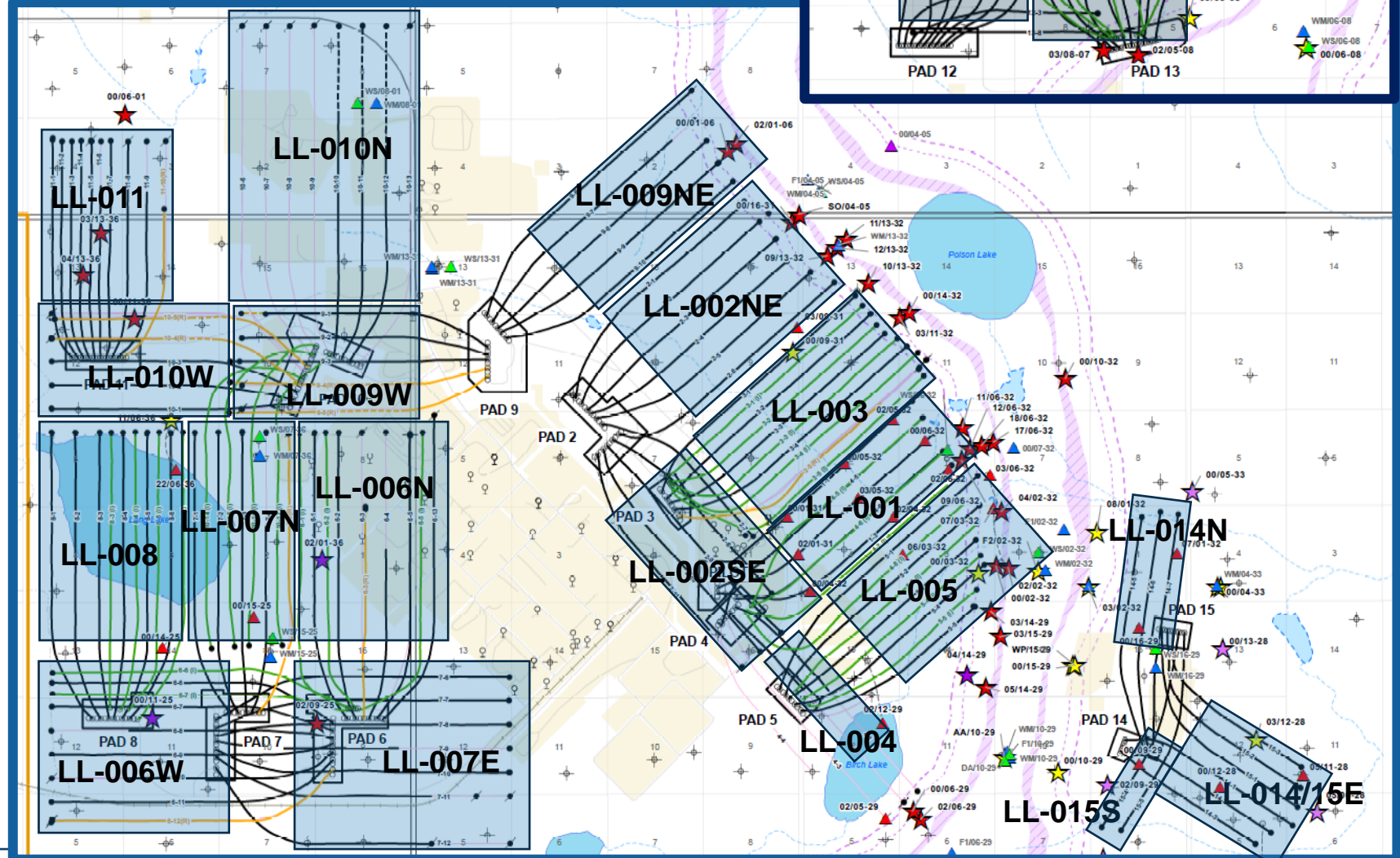
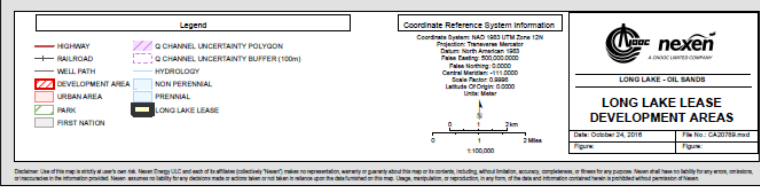
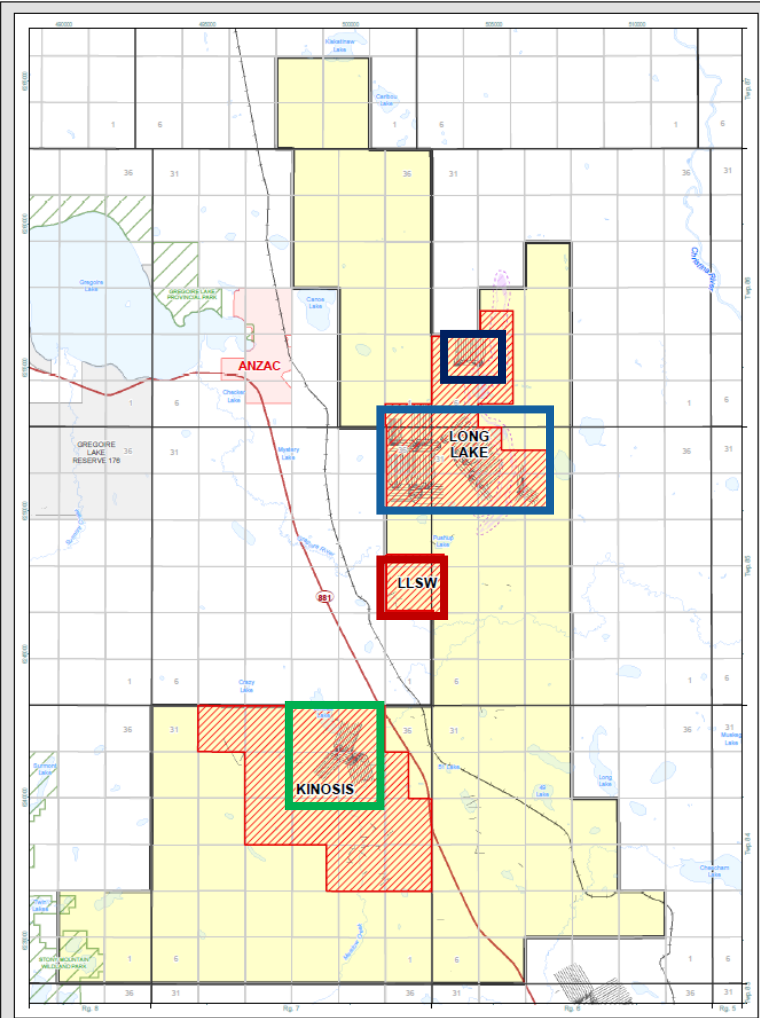
Production History



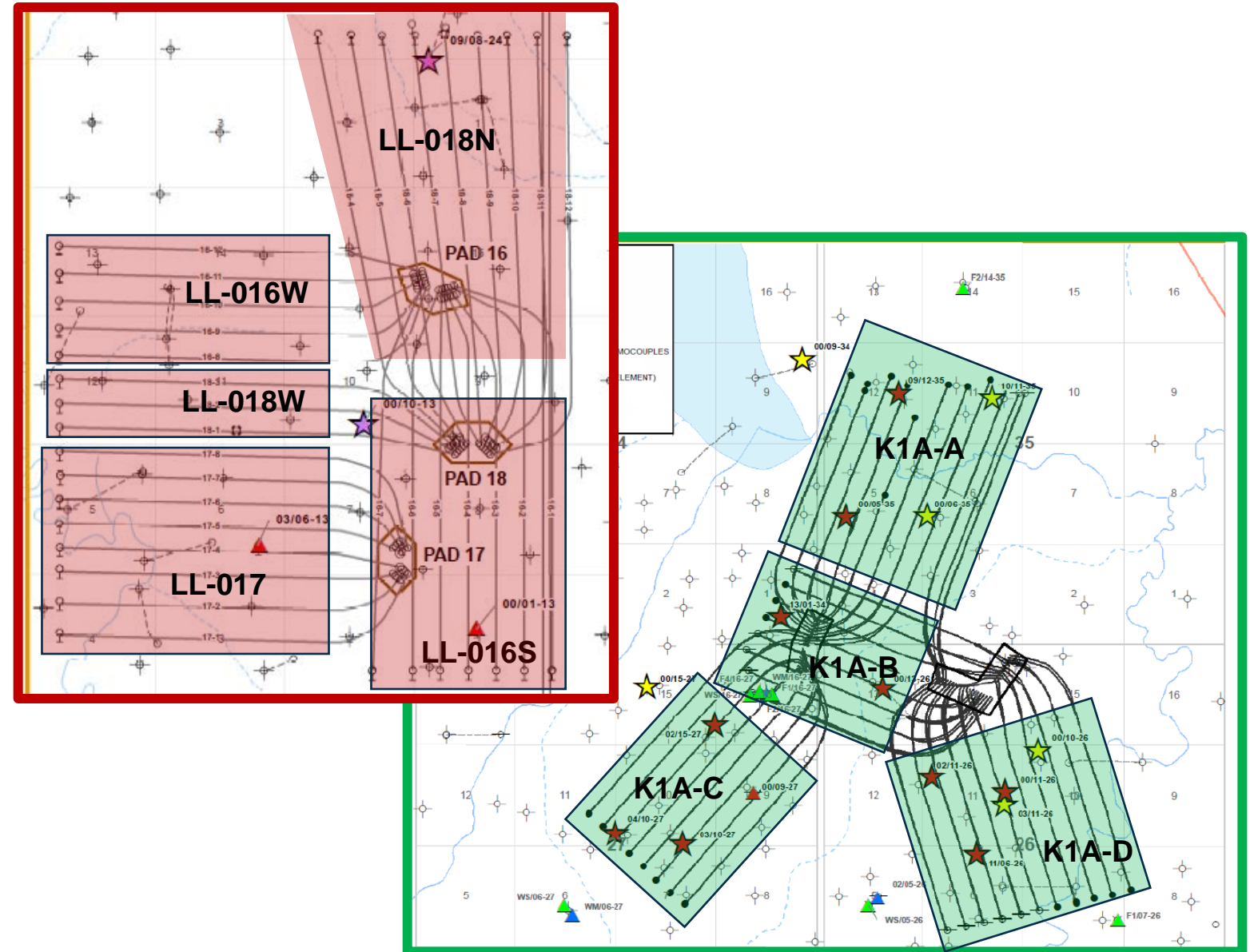
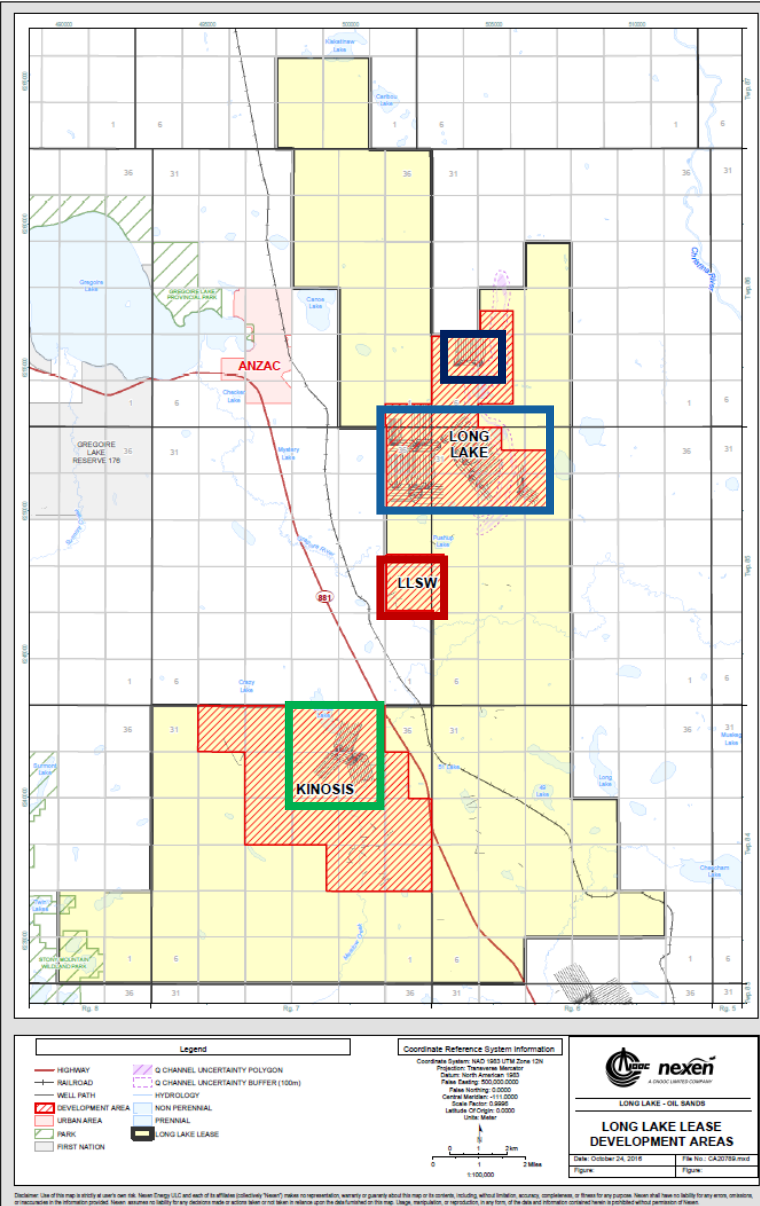


Section 3 – Development Maps

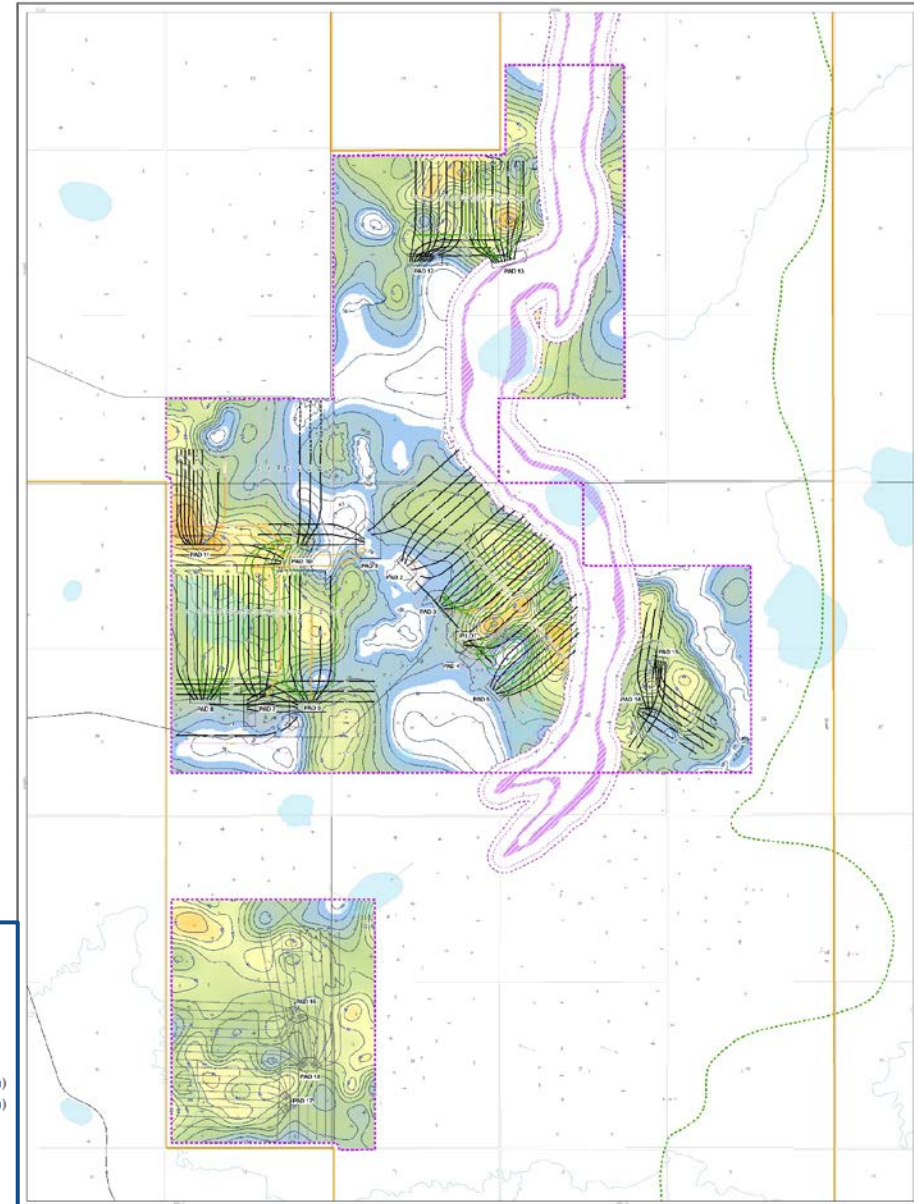
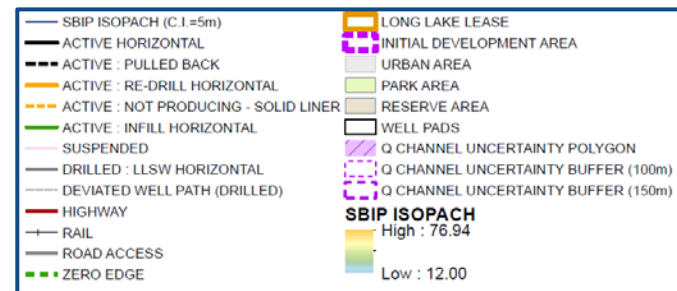
Development Area with Drainage Patterns



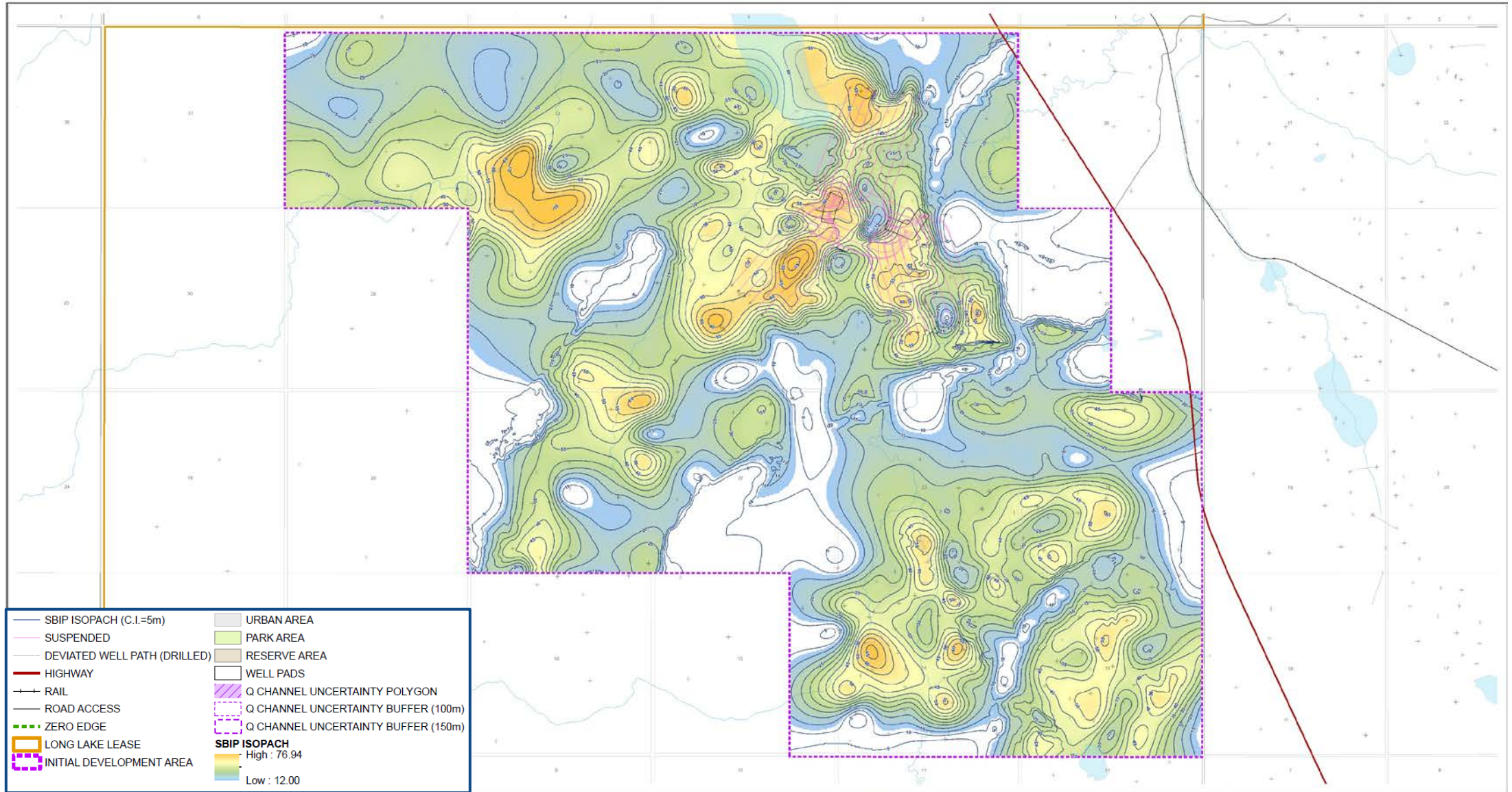
Development Area with Drainage Patterns



- 5m contour interval
- SBIP with resource cut-off
 - Colour-fill cut-off at minimum 12m thickness

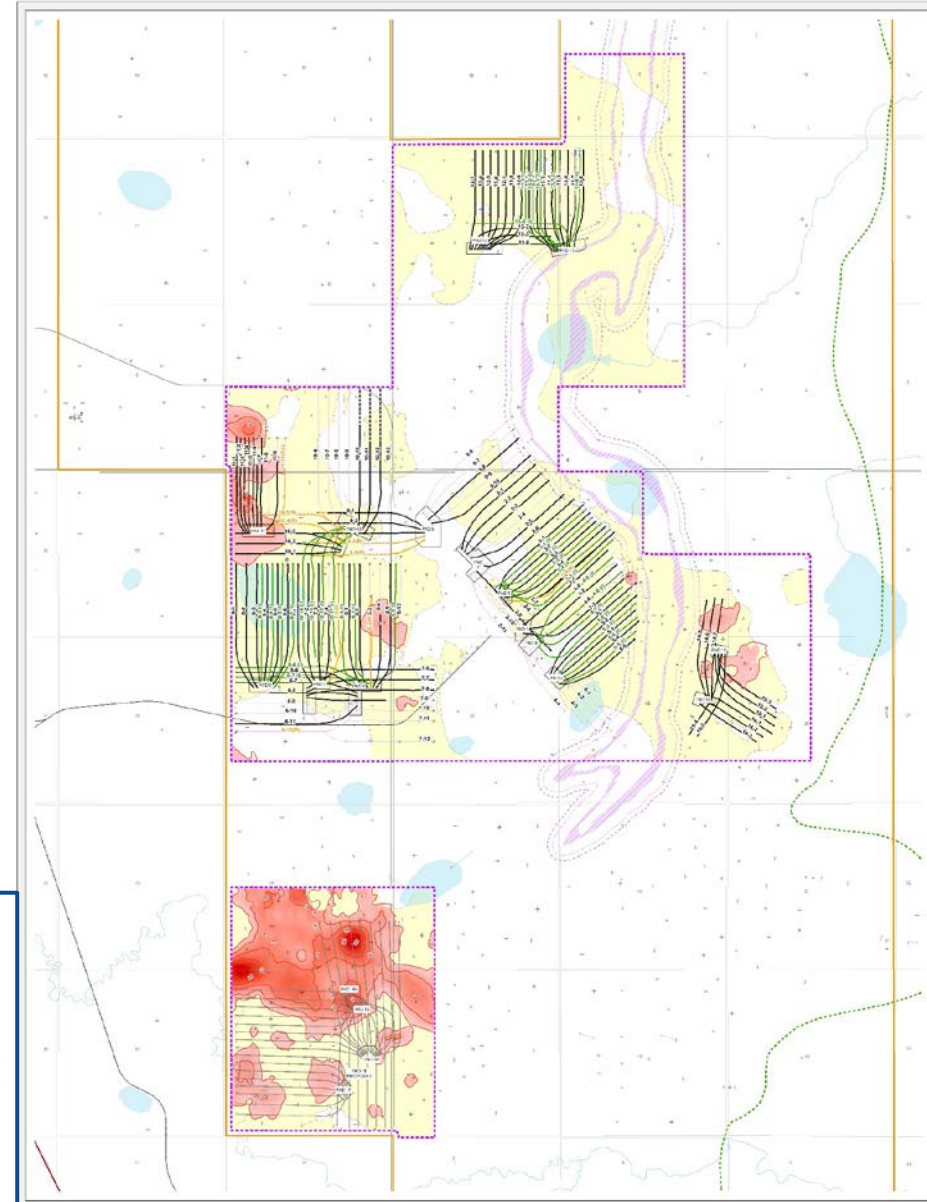
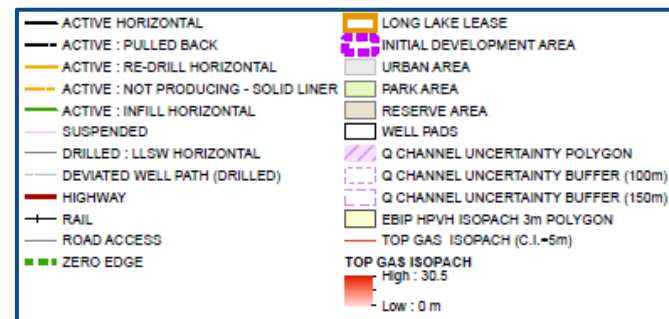


SBIP Pay Isopach - Kinosis

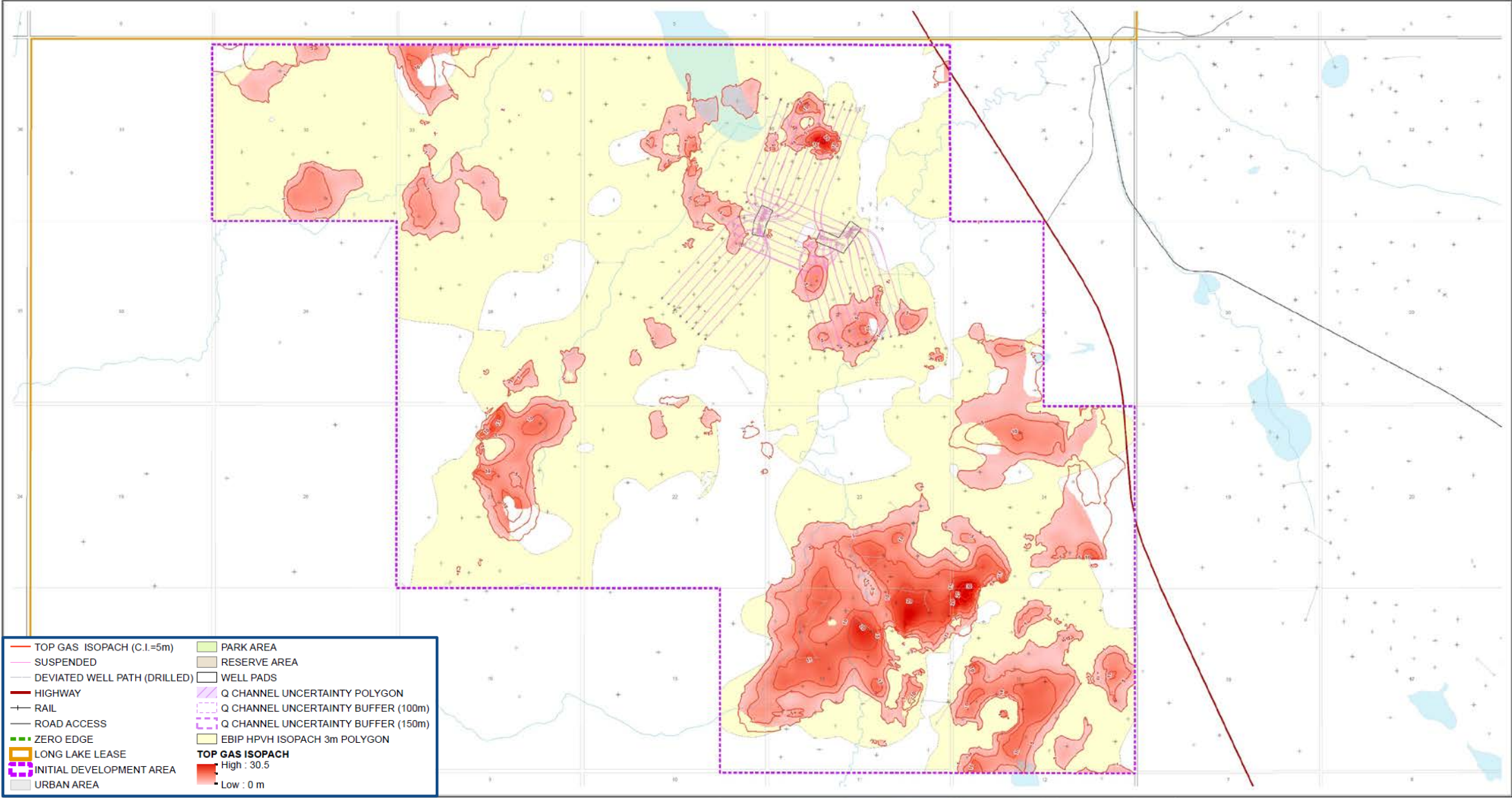


Long Lake Gas Interval in Communication with Pay

- 5m contour interval
- Gas defined by neutron-density porosity cross-over
- Gas associated with SBIP Interval;
 - Directly in contact with top water or top of SBIP interval
 - Colour-fill clipped to area in communication with SBIP pay

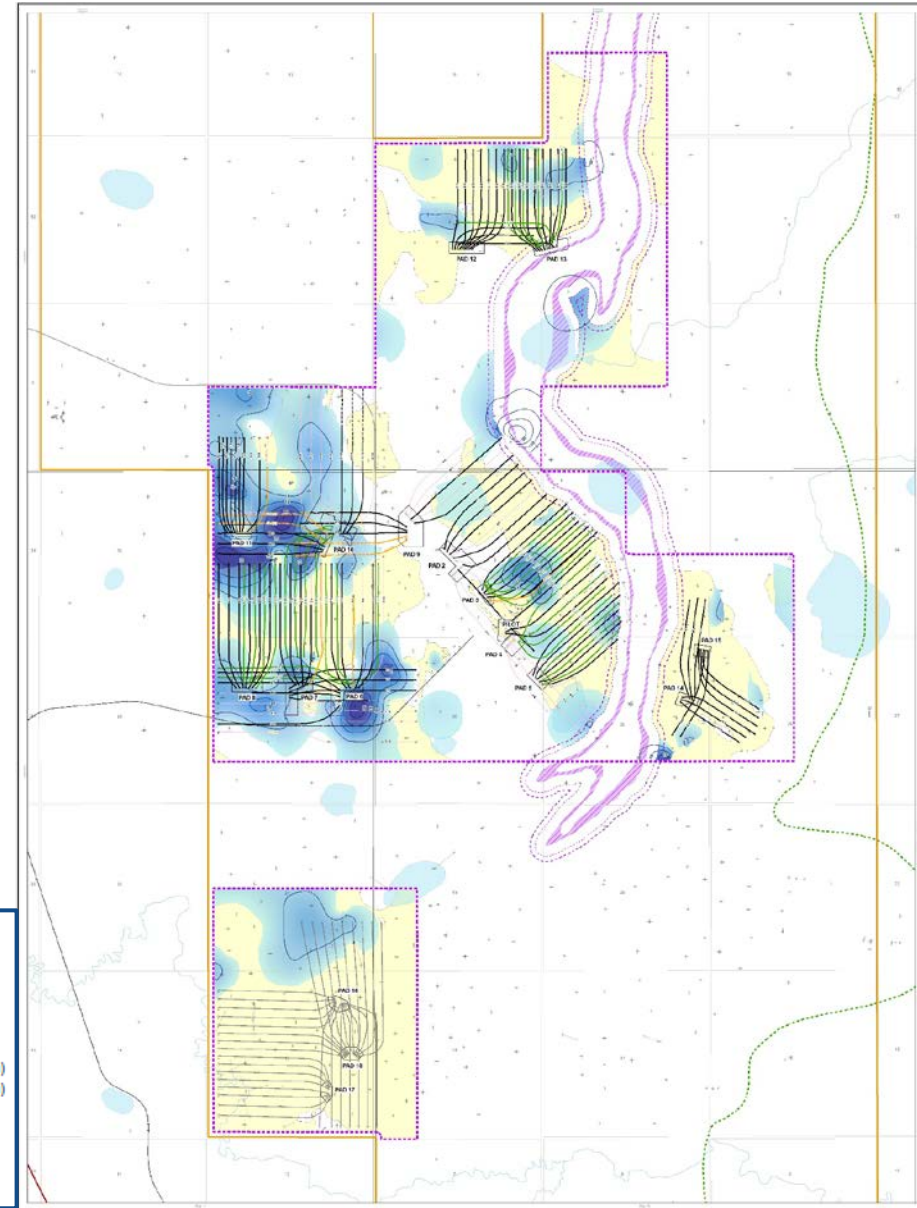
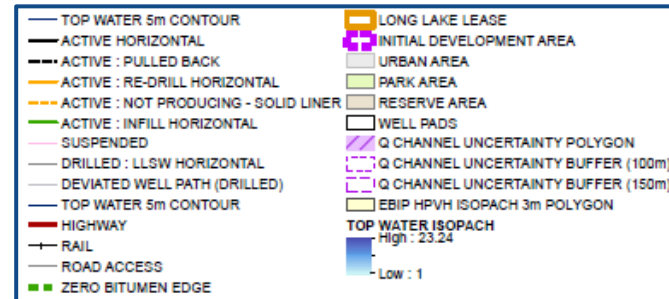


Kinosis Gas Interval in Communication with Pay

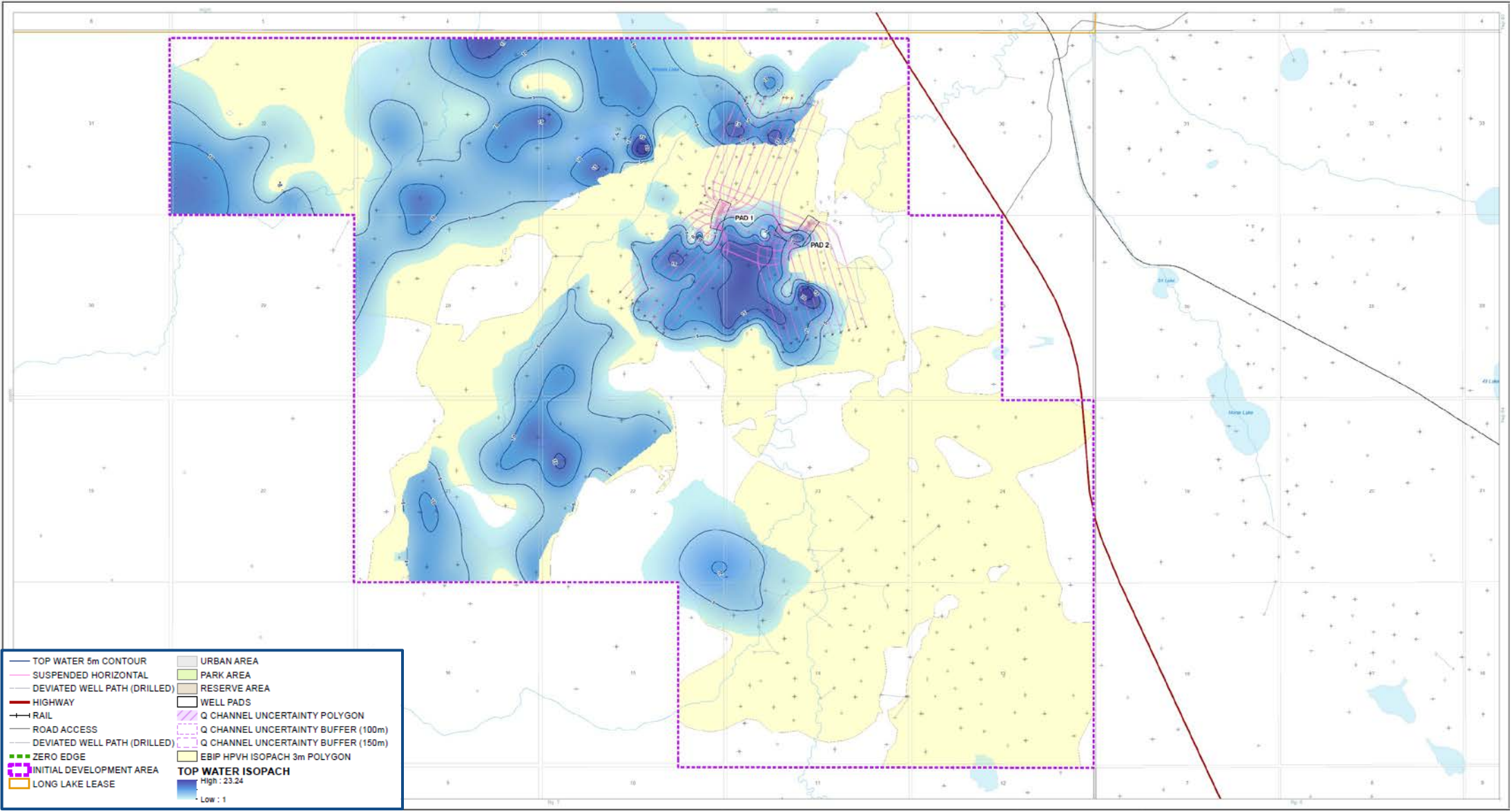


Long Lake Top Water in Communication with Pay

- 5m contour interval
- Top water defined as:
 - Effective water saturation >50% and,
 - Volume Shale <30%
- Top water associated with SBIP Interval;
 - Colour-fill clipped to area in communication with SBIP pay

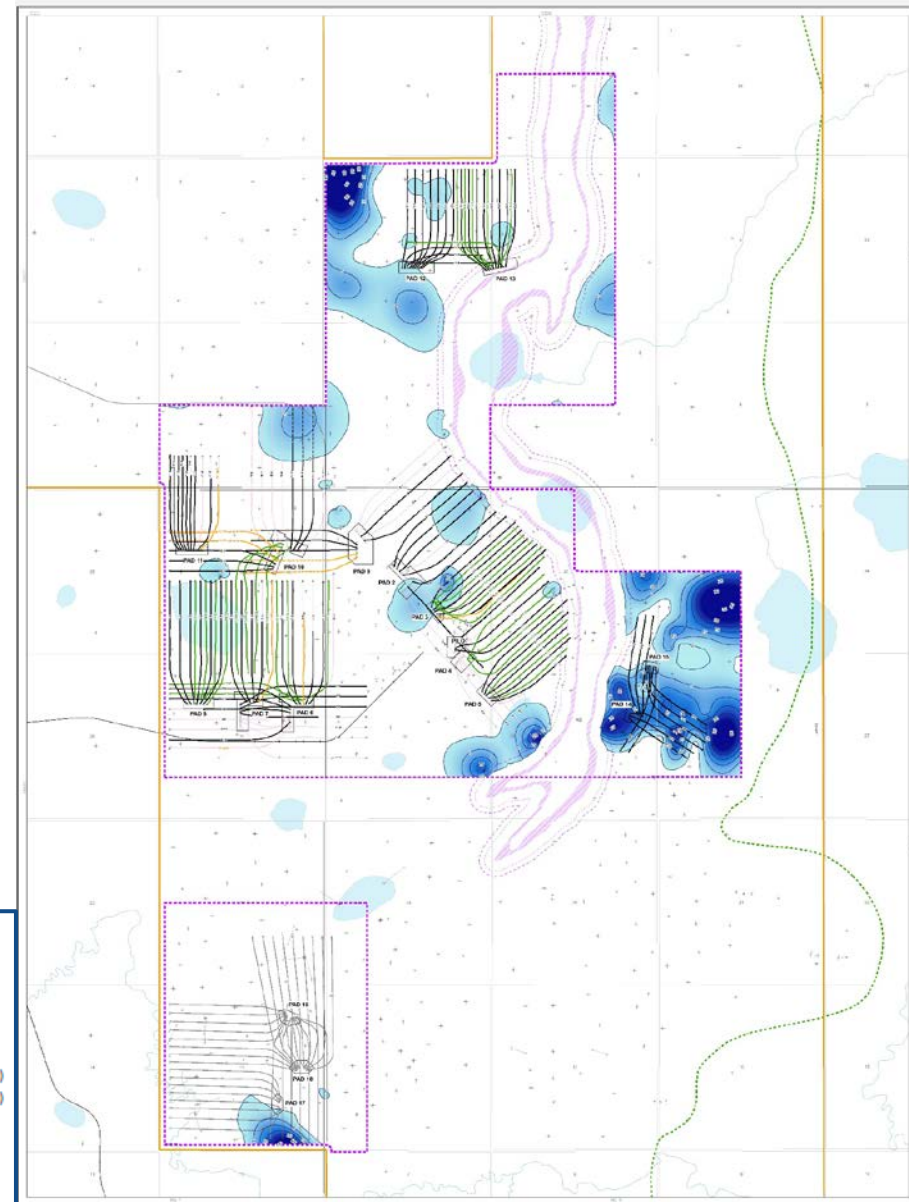
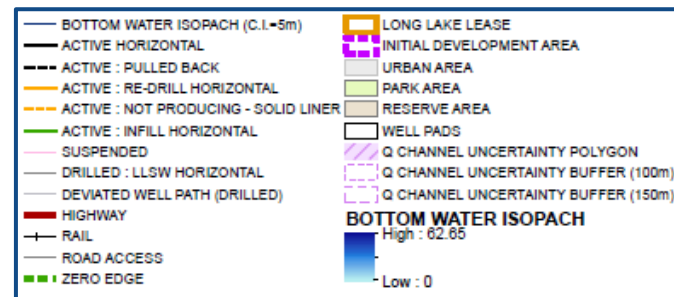


Kinosis Top Water in Communication with Pay

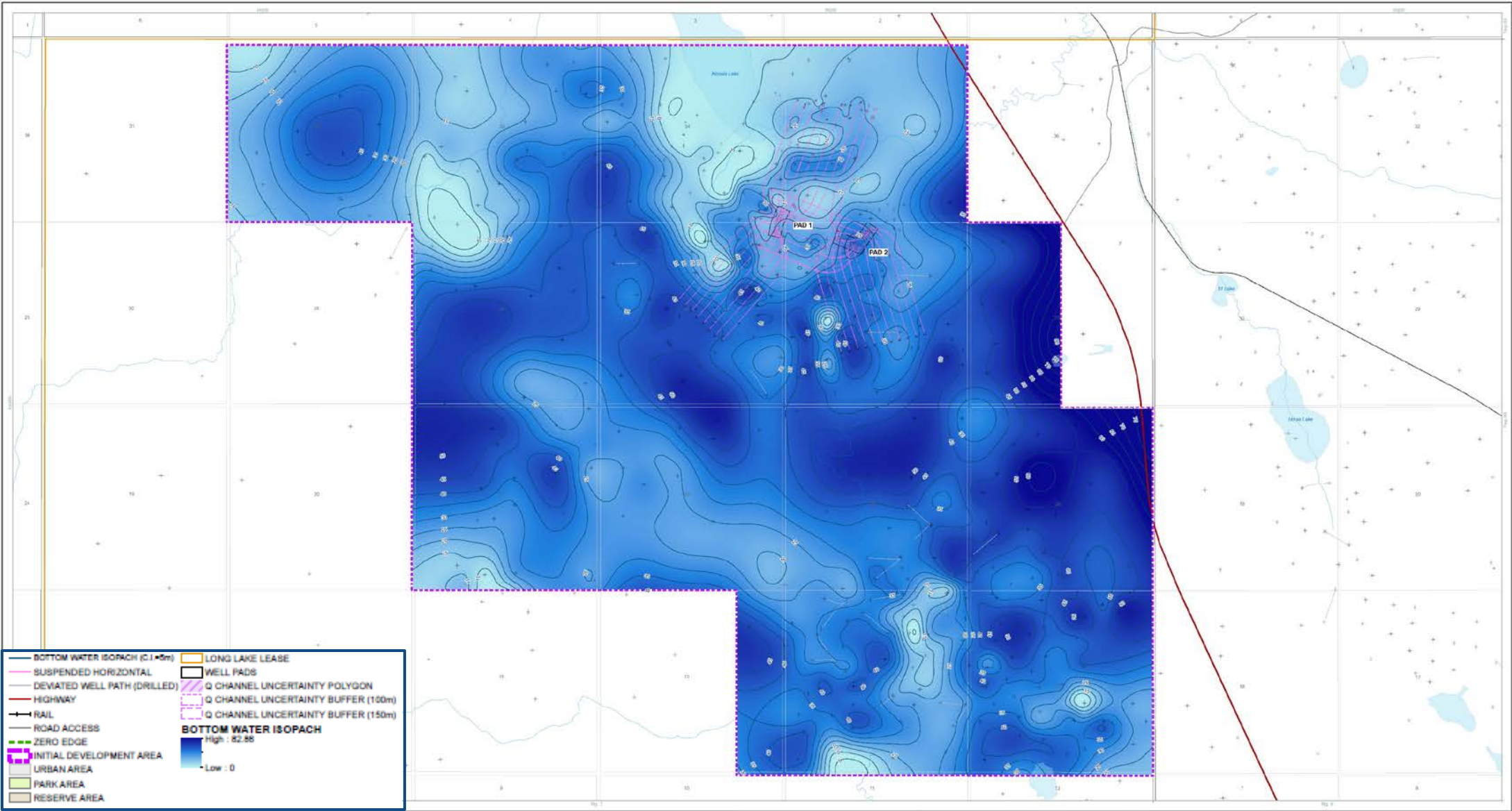


Long Lake Bottom Water Isopach

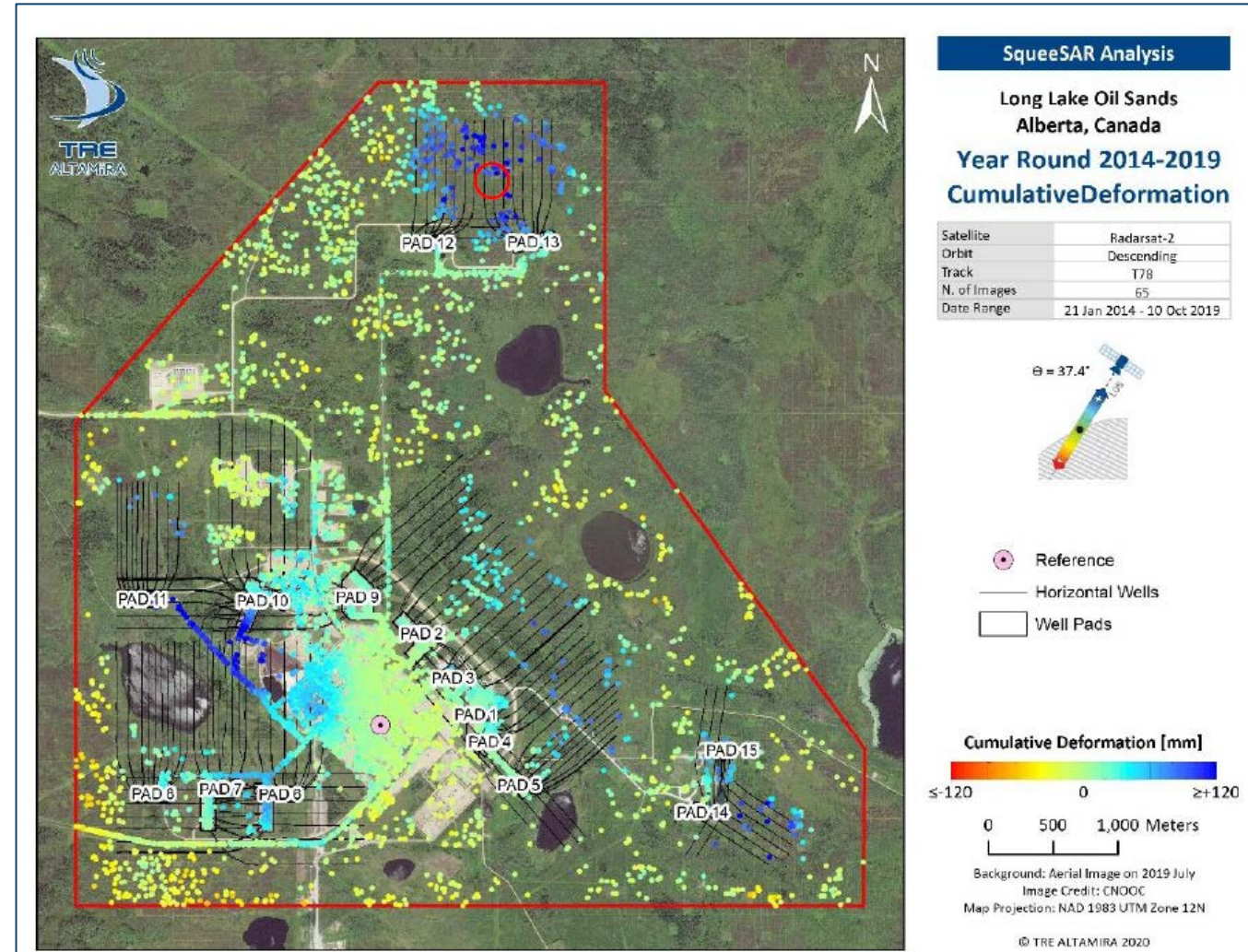
- 5m contour interval
- Bottom water defined as:
 - Effective water saturation >50% and,
 - Volume Shale <30%



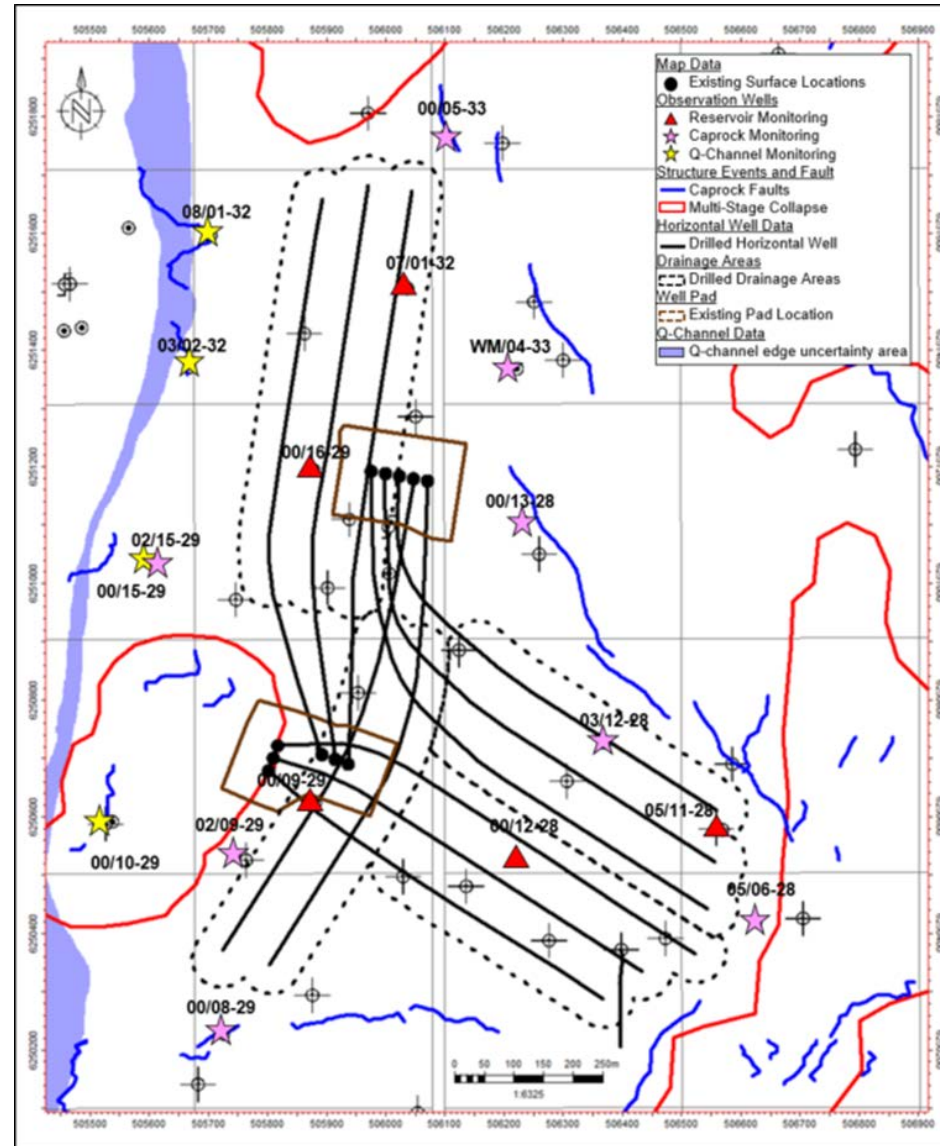
Kinosis Bottom Water Isopach



- No Additional Geomechanical data acquisition in 2020 over Long Lake or Kinosis
- Updated process of interpretation improved consistency in fault classification and resulting in modifications to Pads 14/15 anomalies
 - Current interpretation of the faults indicates that it has been safely operating two wells within the 100 m setback from interpreted faults ~75 m
 - Voluntary self disclosure was submitted to AER September 23, 2020
- InSAR heave data was collected over a portion of Long Lake, immediately surrounding producing Pads 1-15
 - 2017-2019 data was collected and processed by TRE-Altamira
 - Maximum displacement over the last ~5 year period reached 235mm

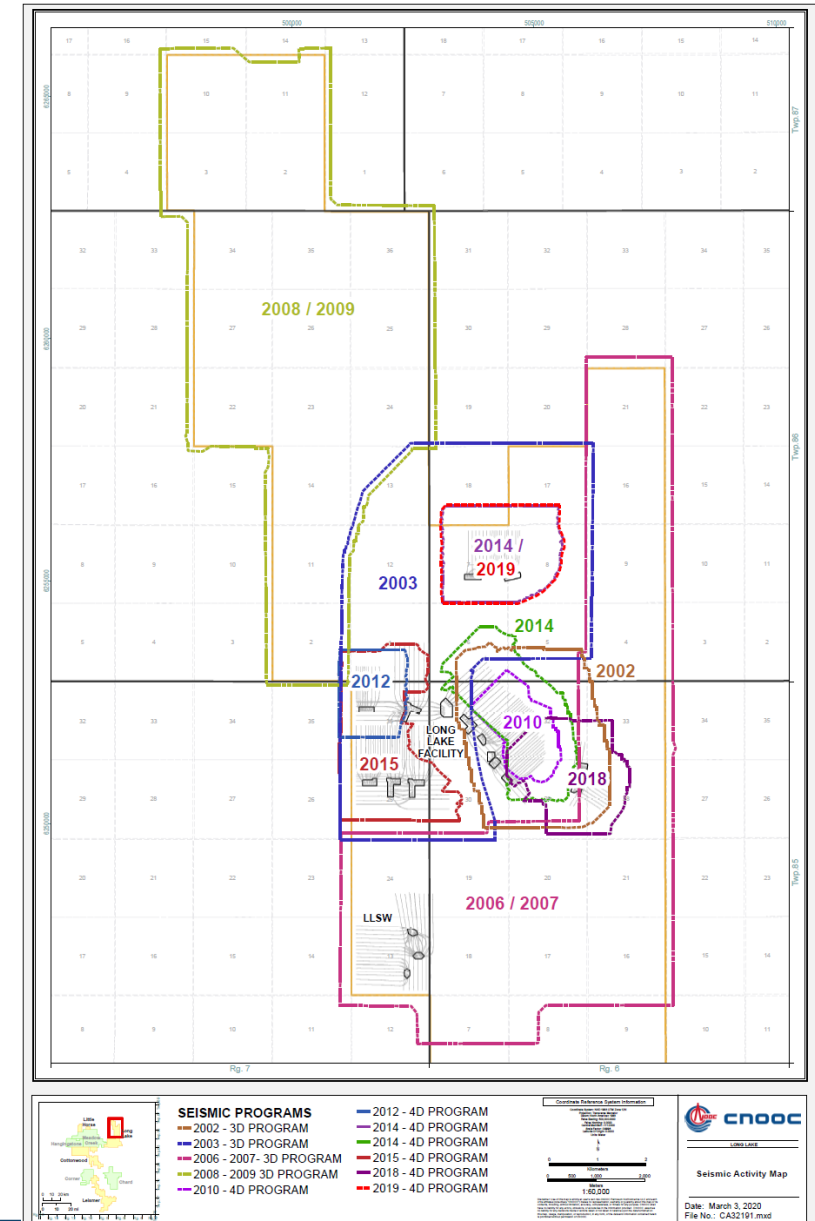
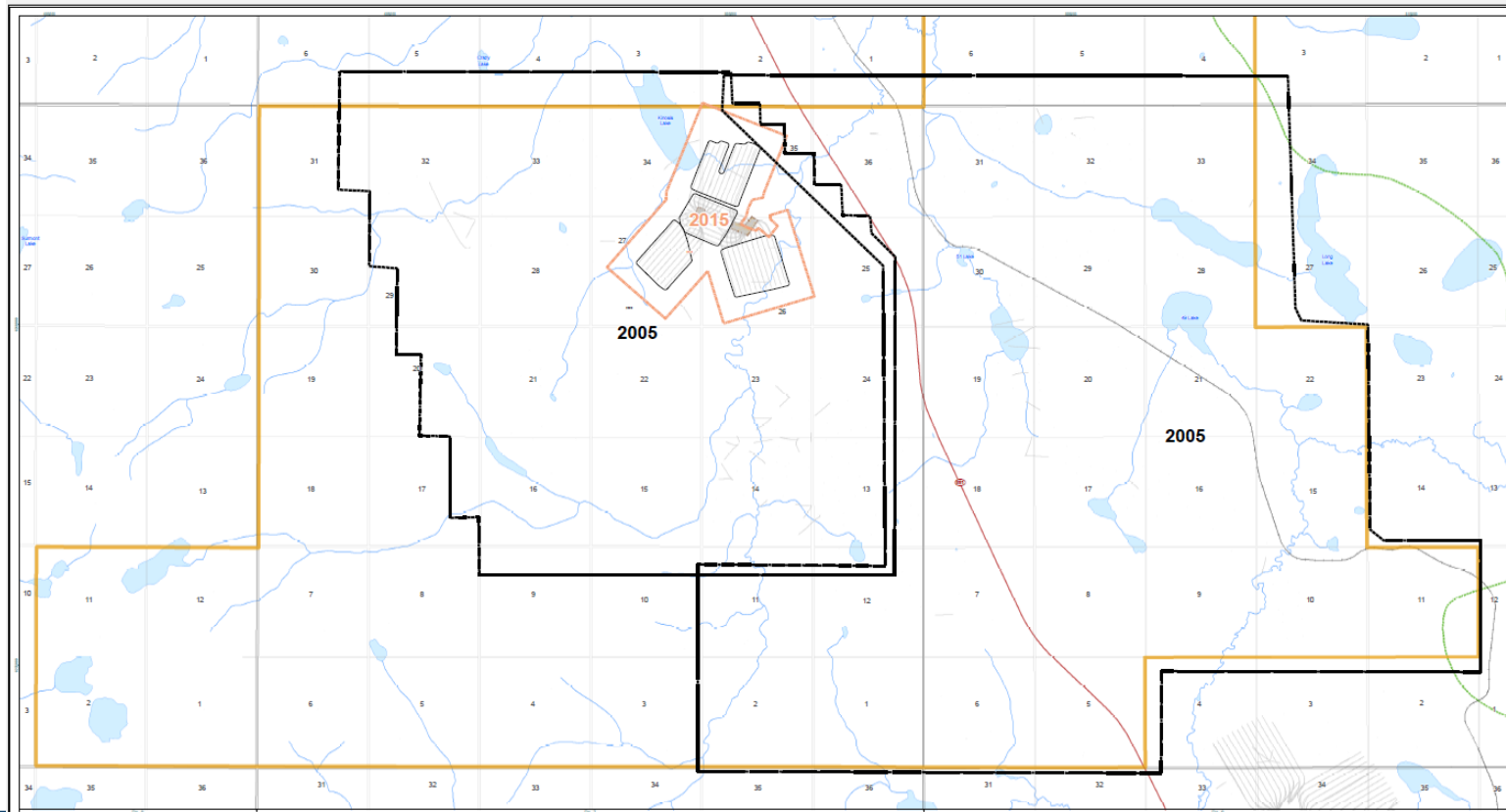


Pads 14/15 Geomechanical Anomalies



Seismic Acquisition

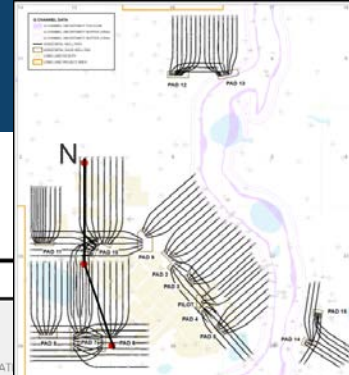
- No additional seismic acquisition in 2020 over LongLake or Kinosis



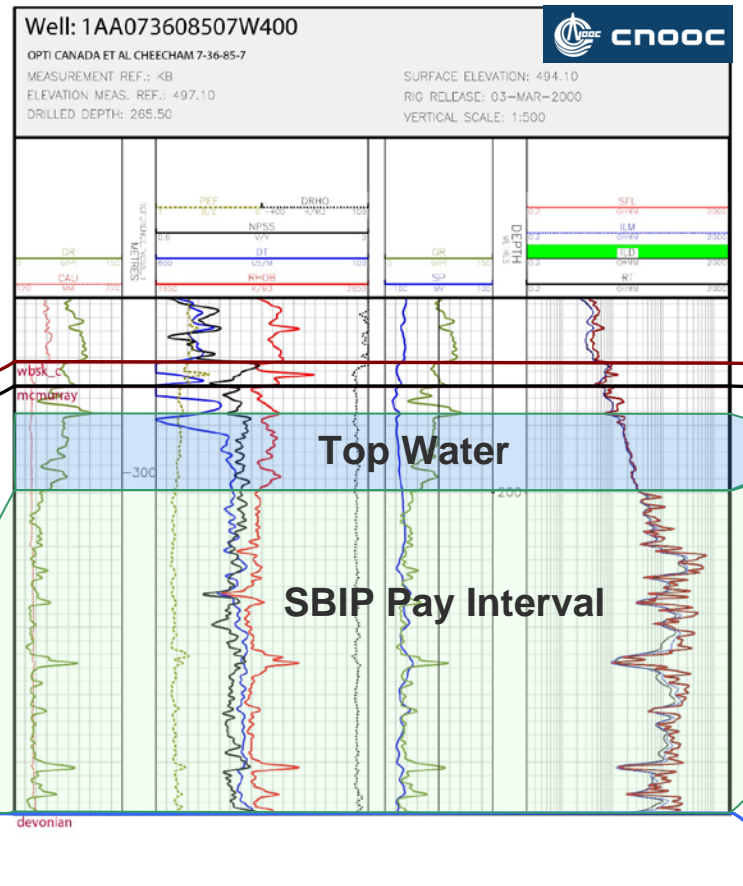
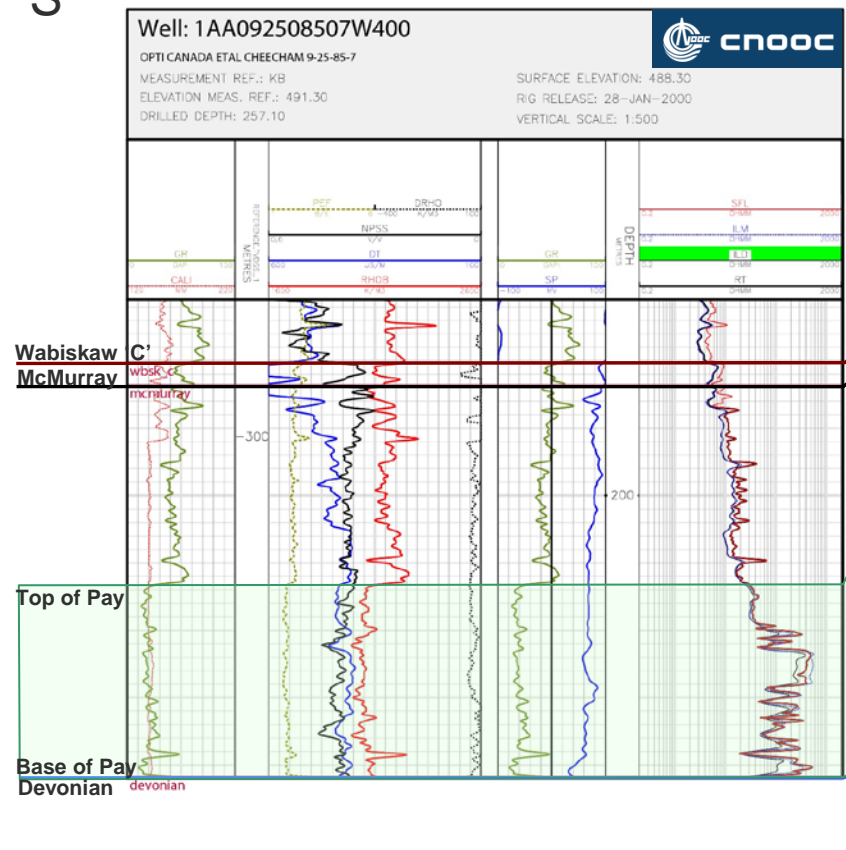


Section 4 – Representative Cross-Sections

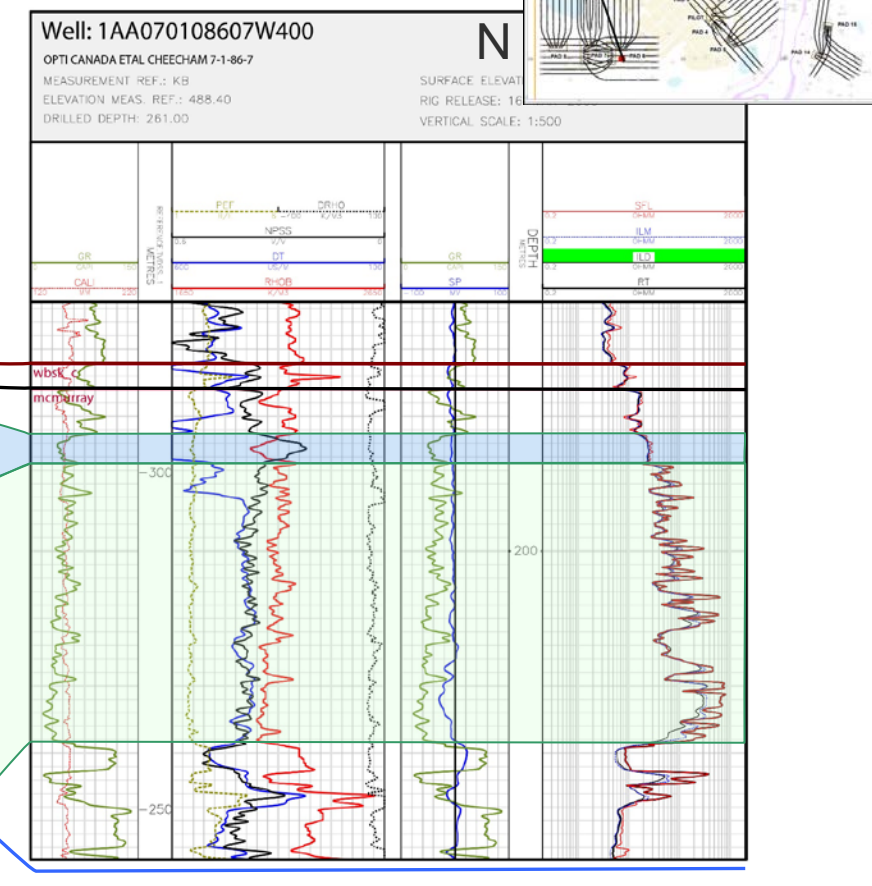
Representative structural cross-section of the West Side of Long Lake (South - North)



S

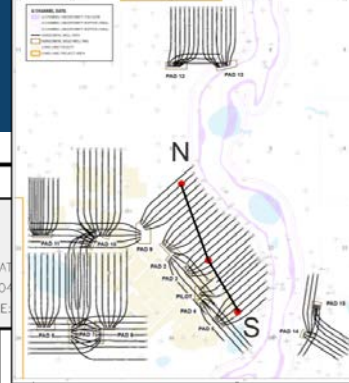
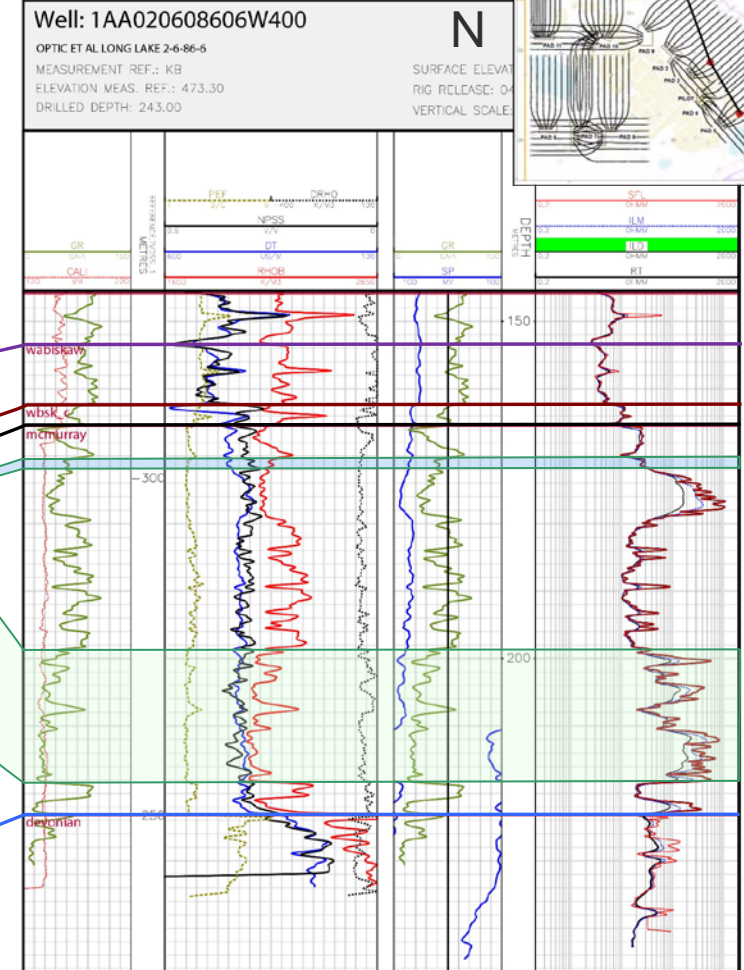
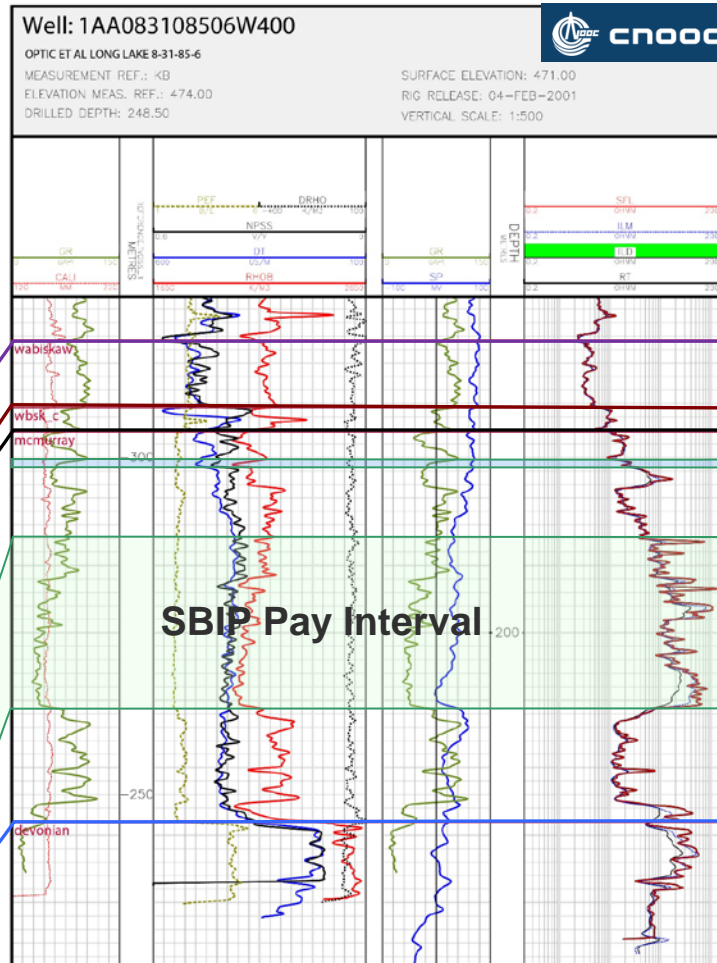
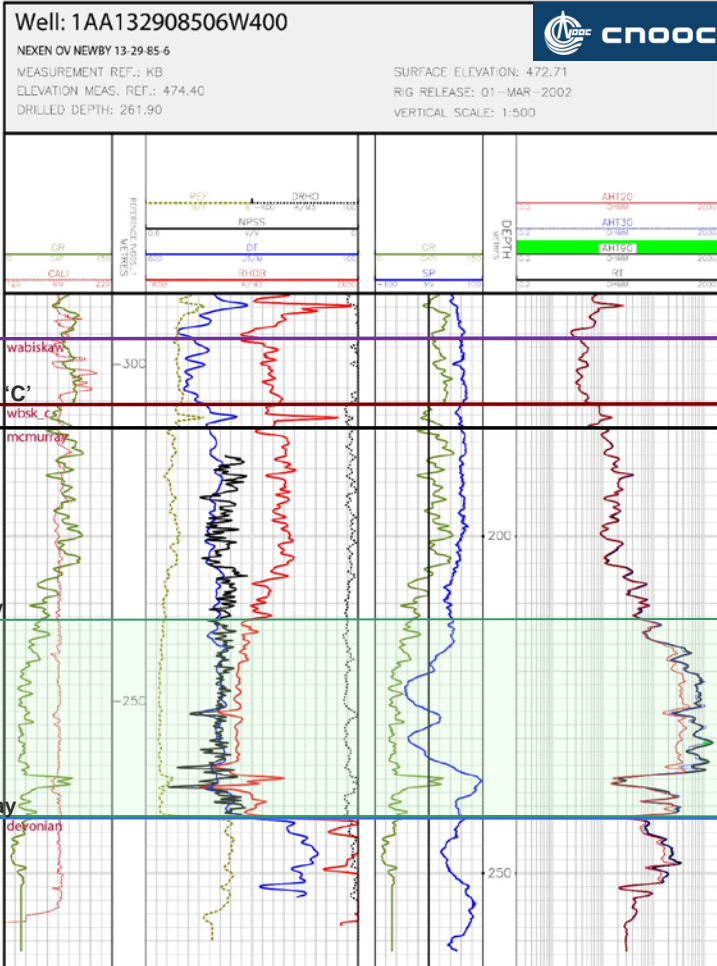


N

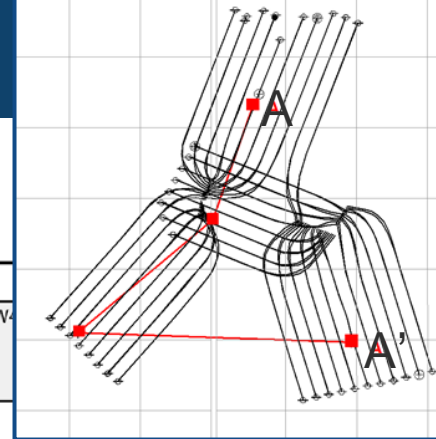


Representative structural cross-section of the East Side of Long Lake (South - North)

S

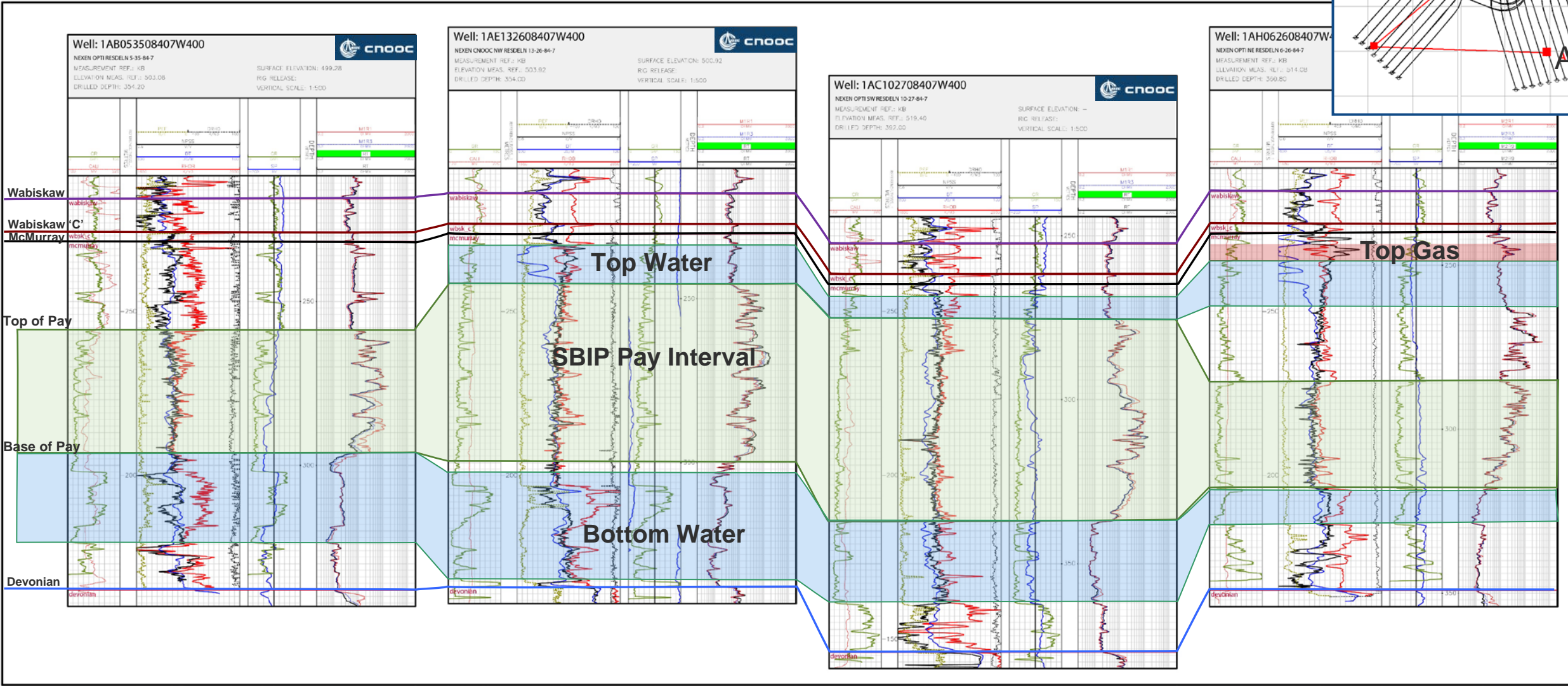


Representative structural cross-section of K1A



A

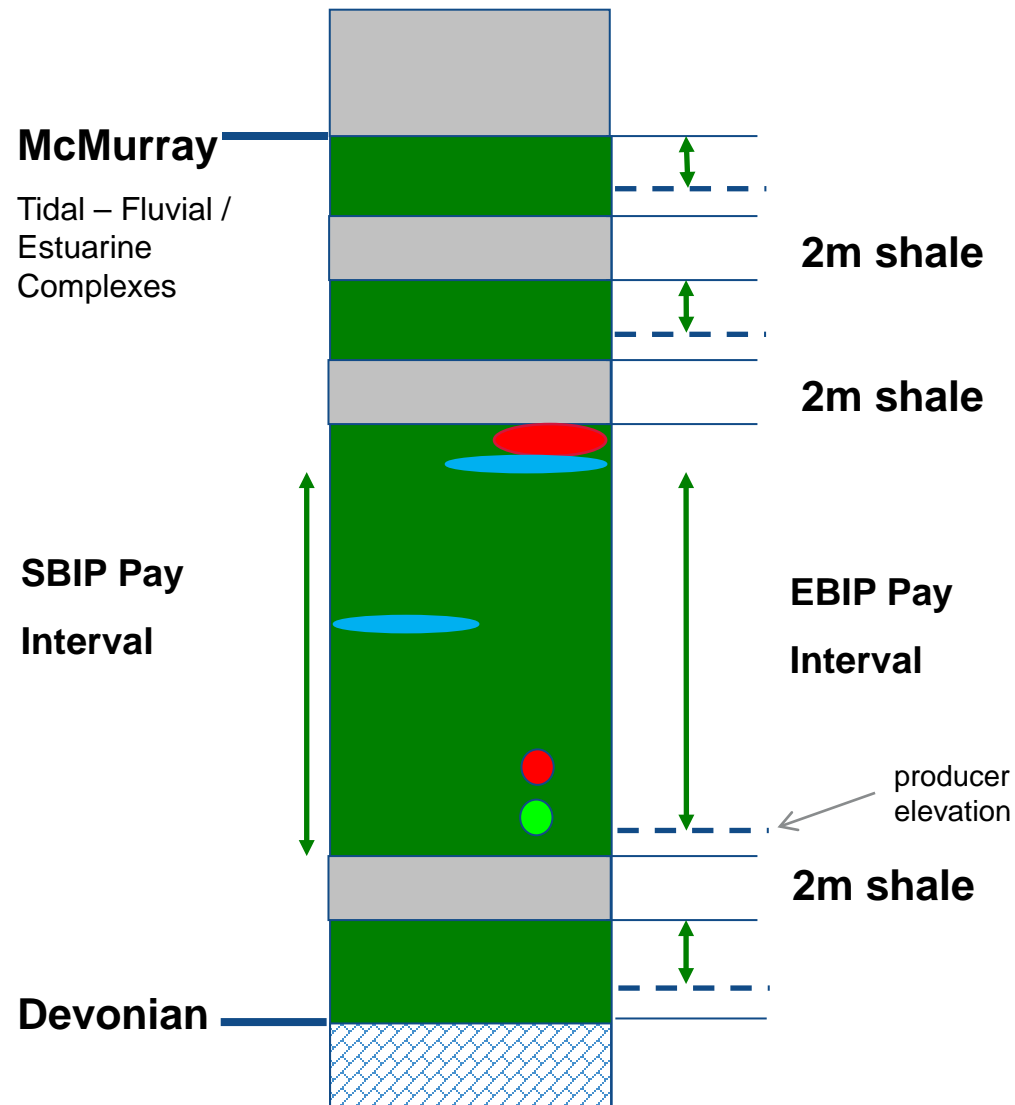
A'





Section 5 – OBIP and Recoverable Tables

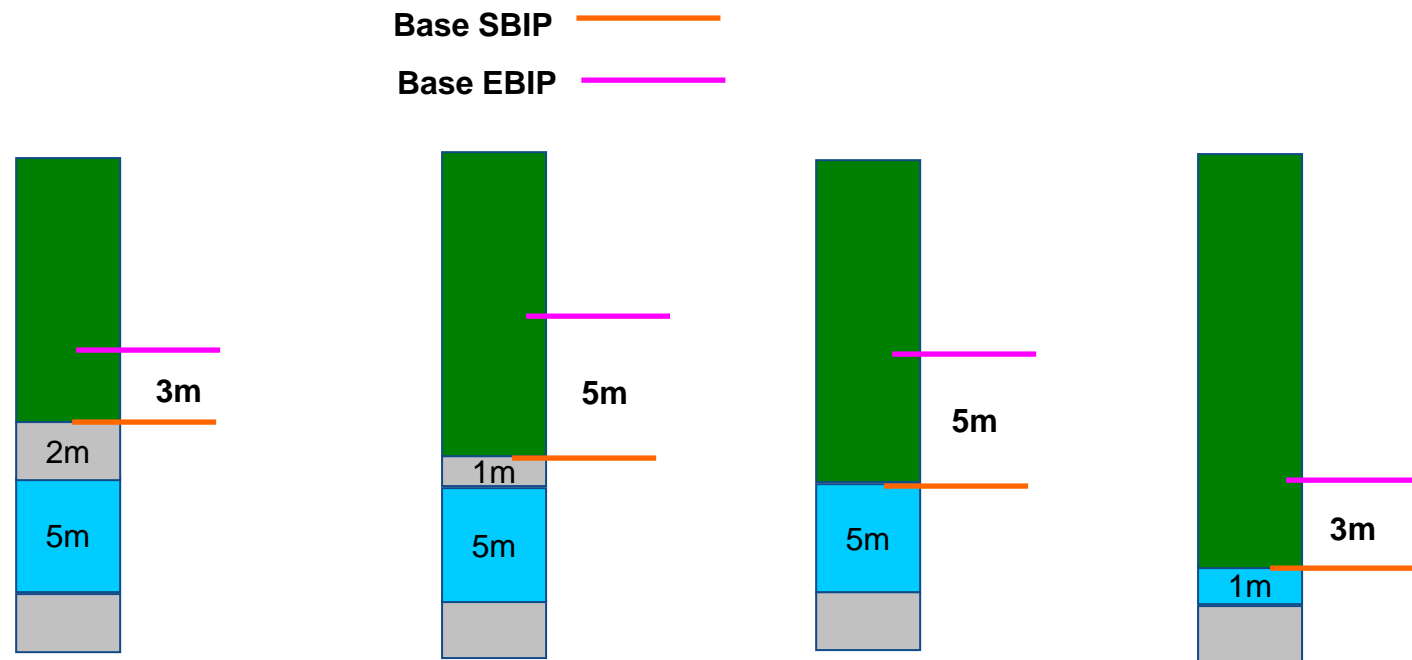
- Pay cut-offs:
 - Top of pay interval is a 2 m shale with > 30% Vshale
 - Focus on low Vshale intervals with thinner and fewer shale beds
 - Account for standoff from bottom water or non-reservoir
- Top of SADGable (SBIP) and Exploitable Bitumen in Place (EBIP) Pay Interval:
 - Single shale interval (> 30% Vshale) of 2m
 - Cumulative shale interval (> 30% Vshale) of 4m
- Base of SBIP Pay Interval:
 - Base of bitumen pay/reservoir rock
- Base of EBIP Pay Interval:
 - Depth of an existing or planned horizontal well pair (EBIP pay base = producer well depth)
 - Stand-off from bitumen/water contact or non-reservoir
- Gas Interval(s) Associated with EBIP/SBIP Pay Interval
 - Gas identified by neutron/density crossover
- High Water Saturation Interval(s) Associated with EBIP/SBIP Pay Interval
 - > 50% Swe (effective water saturation) and < 30% Vshale
- EBIP will be calculated from a hydrocarbon pore volume height (HPVH) map.
 - Minimum EBIP HPVH and Pay Interval Contour ($3\text{m}^3/\text{m}^2$ EBIP HPVH = 12m EBIP Pay Interval)



- **SBIP Pay Interval:**
 - $< 30\% V_{\text{shale}}$
 - $< 50\% S_{\text{we}}$
- May have associated:
 - gas interval(s)
 - high water saturation interval(s)
- Primary zone defined as the thickest pay interval unless:
 - an existing (or planned) horizontal well pair is within an interval
 - geologists have interpreted continuity of an interval across an area
- Reservoir Rock
 - Sand
 - Breccia
 - IHS with $< 30\% V_{\text{shale}}$

- Base of EBIP Pay Interval:

- Depth of an existing or planned horizontal well pair (EBIP Pay Interval base = producer well depth)
- 3 m stand-off if no bottom water (minimum shale of 2 m thickness)
- 5 m stand-off if in contact with bottom water (minimum bottom water thickness of 2 m)



Long Lake Development Areas: EBIP and Reservoir Parameters



Project Area	Development Area	Existing Pad	Well Count	Cumulative Production, YE 2020 (e6m3)	EUR	EBIP	SBIP	SBIP	Reservoir Parameters			
					(e6m3)	(e6m3)	(e6m3)	Current RF	Avg Thickness (m)	Avg Porosity (%)	Avg Eff Sw (%)	Permeability: Kmax/Kvert (mD)
Long Lake	Long Lake			23.5		105	131	18%	22	0.31	0.32	4470/2270
	LLSW			0.0		31	37	0%	24	0.32	0.26	3730/2320
	Kinosis			0.2		205	239	0%	23	0.31	0.23	4030/2340



Section 6 – Well Pad Parameters and Performance

Well Pad Parameters and Performance



Project Area	Development Area	Existing Pad	Well Count	Cumulative Production, YE 2020 (e6m3)	EUR	EBIP	SBIP	SBIP	Reservoir Parameters				
					(e6m3)	(e6m3)	(e6m3)	Current RF	Avg Thickness (m)	Avg Porosity (%)	Avg Eff Sw (%)	Permeability: Kmax/Kvert (mD)	Area (ha)
Long Lake	Long Lake	LL-001*	5	1.6	2.2	2.8	3.4	46%	33	0.32	0.34	4470/2270	35
		LL-002NE	6	0.9	1.1	2.5	3.2	30%	23	0.30	0.30	4470/2270	52
		LL-002SE	5	0.3	0.3	1.2	1.5	21%	18	0.30	0.40	4470/2270	39
		LL-003*	10	1.7	2.5	3.2	4.0	42%	28	0.31	0.33	4470/2270	49
		LL-004	2	0.1	0.1	0.1	0.2	61%	14	0.31	0.33	4470/2270	25
		LL-005*	10	2.2	2.8	3.3	3.8	58%	35	0.31	0.32	4470/2270	42
		LL-006N*	9	1.1	1.8	4.0	4.2	26%	30	0.30	0.27	4470/2270	60
		LL-006W*	9	1.0	1.4	2.4	2.7	37%	16	0.31	0.31	4470/2270	67
		LL-007E	7	0.9	1.8	2.4	2.7	34%	21	0.30	0.35	4470/2270	60
		LL-007N*	9	2.9	3.9	4.4	4.4	65%	36	0.30	0.25	4470/2270	50
		LL-008*	10	2.2	2.1	4.2	4.9	44%	36	0.29	0.32	4470/2270	59
		LL-009NE	5	0.3	0.3	1.2	1.9	15%	15	0.30	0.41	4470/2270	47
		LL-009W	5	0.6	0.7	1.9	2.0	28%	25	0.29	0.28	4470/2270	39
		LL-010N	8	0.5	0.5	2.7	3.7	13%	14	0.31	0.28	4470/2270	96
		LL-010W	5	1.2	1.9	3.0	3.2	37%	46	0.31	0.46	4470/2270	39
		LL-011	10	1.8	2.1	2.8	3.2	55%	36	0.32	0.35	4470/2270	41
		LL-012	9	1.4	2.1	3.6	4.8	29%	32	0.32	0.30	4470/2270	50
		LL-013*	15	1.9	2.8	3.8	4.9	38%	31	0.32	0.32	4470/2270	50
		LL-014/15E	6	0.4	0.6	1.3	1.9	24%	19	0.32	0.20	4470/2270	27
	LL-014N	3	0.4	0.9	1.5	1.8	24%	30	0.33	0.21	4470/2270	19	
	LL-015S	2	0.2	0.3	0.8	0.9	24%	28	0.31	0.20	4470/2270	12	
	LLSW	LL-016S	7	0.0	2.0	3.6	4.5	0%	24	0.32	0.24	3730/2320	63
	LL-016W	5	0.0	1.5	2.7	3.0	0%	28	0.33	0.30	3730/2320	42	
	LL-017	8	0.0	2.5	4.2	6.0	0%	28	0.32	0.24	3730/2320	66	
	LL-018N	9	0.0	3.1	6.0	6.6	0%	33	0.32	0.32	3730/2320	84	
	LL-018W	3	0.0	1.0	1.6	1.8	0%	28	0.33	0.26	3730/2320	23	
	Kinosis	K1A-A	9	0.0	2.5	4.6	5.6	0%	33	0.33	0.24	4030/2340	64
	K1A-B	8	0.0	2.2	3.9	4.5	0%	37	0.32	0.23	4030/2340	42	
K1A-C	8	0.1	3.0	5.1	6.5	2%	42	0.33	0.23	4030/2340	48		
K1A-D	11	0.0	3.0	5.6	6.7	1%	33	0.33	0.20	4030/2340	64		

*includes infills



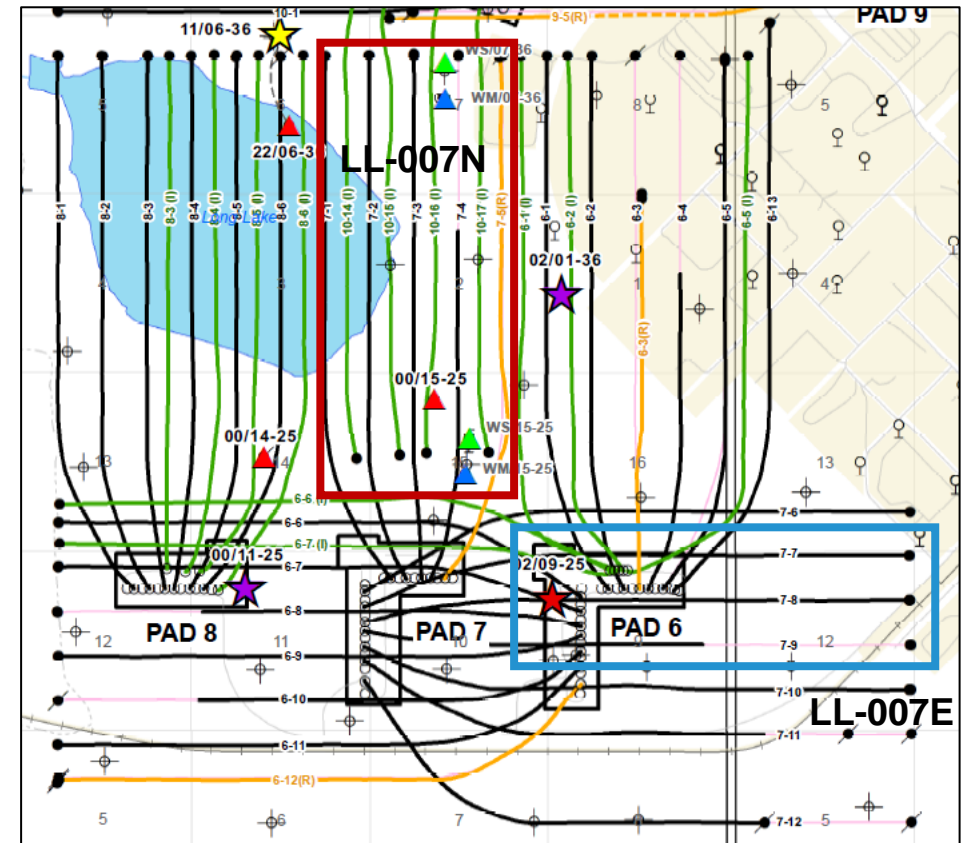
Section 7 – Co-Injection

PAD 7E NCG:

- Application approval 9485R received in Q3 2012
 - Natural gas injection started Q4 2014 at 7P7 – 7P9
 - Gas injection suspended after 2015 turnaround
 - No NCG injection through 2020
 - Evaluating re-start of NCG injection in 2021

PAD 7N NCG:

- Application approval 9485CC received in Q2 2014
 - Construction of co-injection surface facilities complete Q2 2015 on 5 well pairs planned
 - Short term NCG injection around 2015 facility turnaround
 - No NCG injection through 2020
 - Re-start of NCG injection planned for Q2 2021
 - AER informed of re-start plans in April 2021



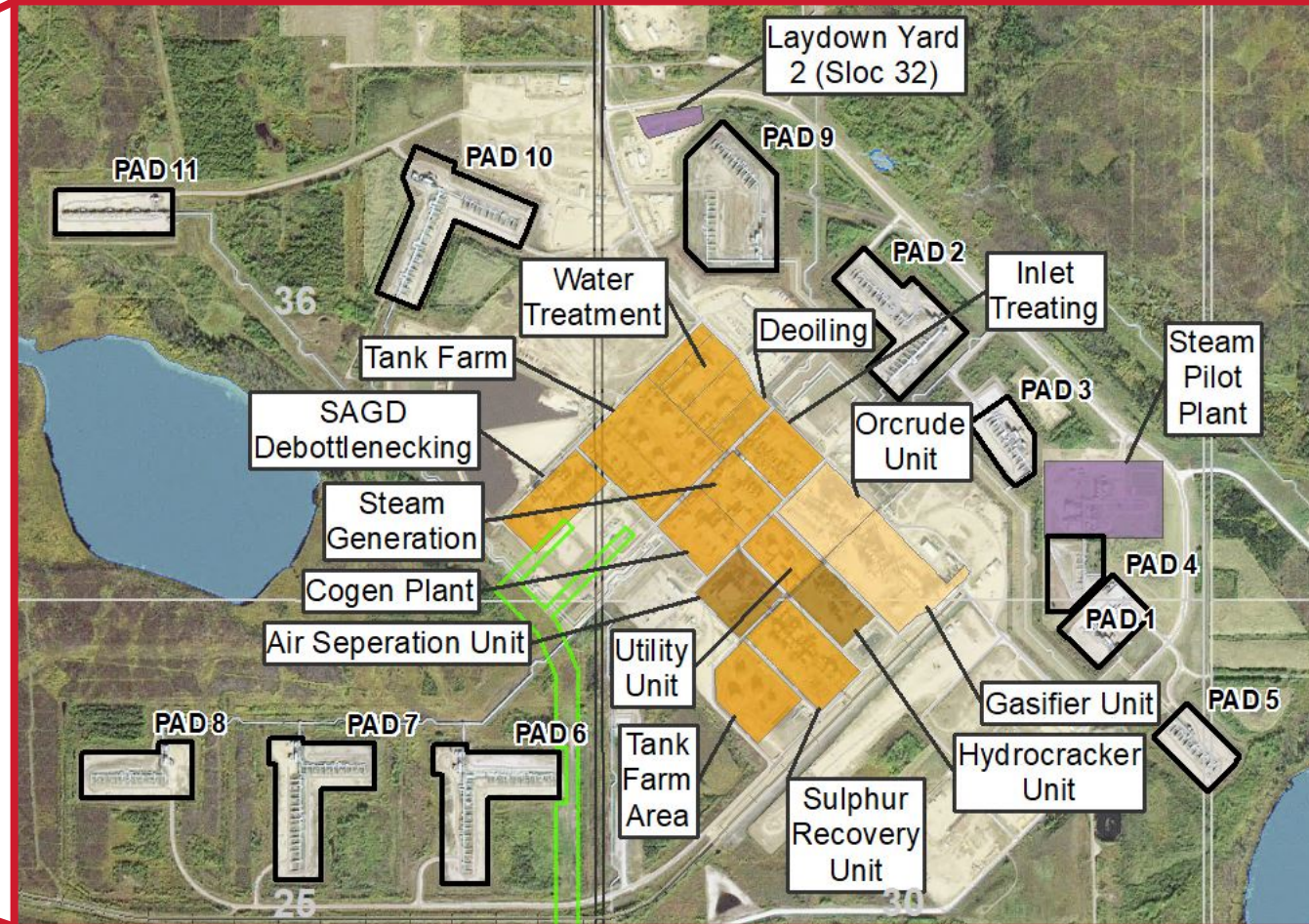


Sections 8 to 12 - Surface



Section 8 – Surface Infrastructure

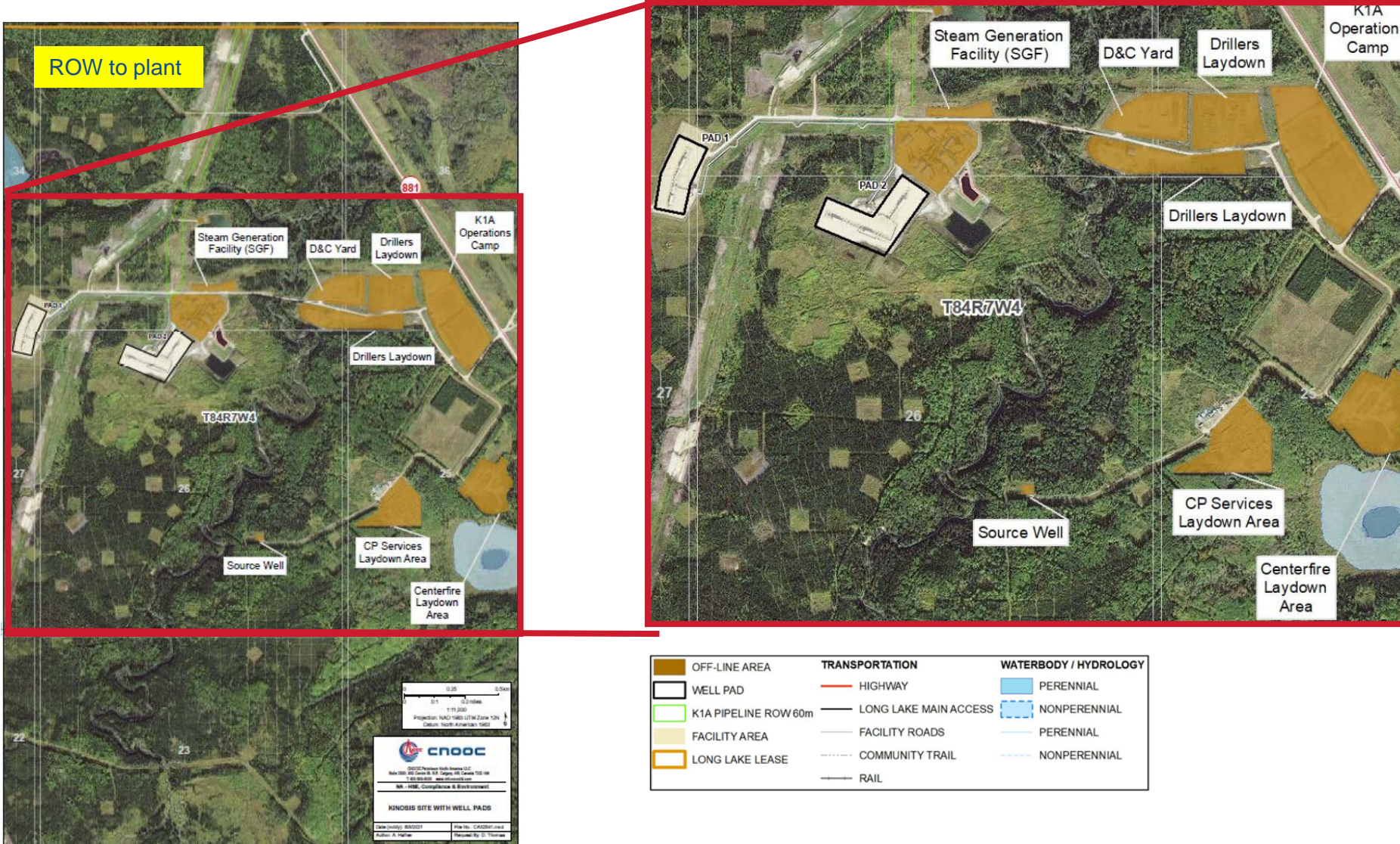
Long Lake Facilities Map



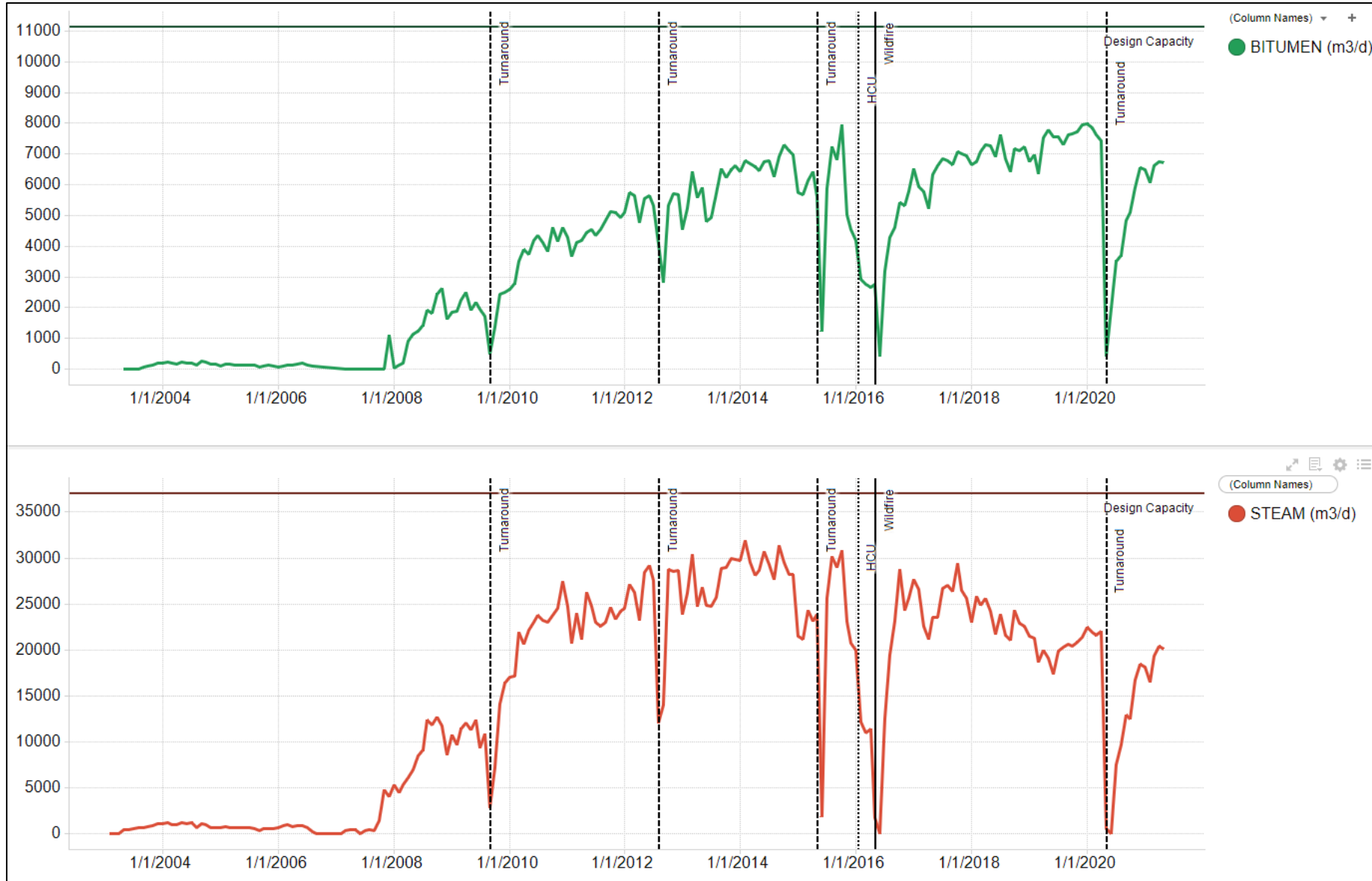
ACTIVE PLANT AREA	WELL PAD	TRANSPORTATION	WATERBODY / HYDROLOGY
SAGD (Running)	WELL PAD	HIGHWAY	PERENNIAL
SAGD SUPPORT (Running)	K1A PIPELINE ROW 60m	LONG LAKE MAIN ACCESS	NONPERENNIAL
UPGRADER WINTERIZED (awaiting go forward strategy)	FACILITY AREA	FACILITY ROADS	PERENNIAL
OFF-LINE	LONG LAKE LEASE	COMMUNITY TRAIL	NONPERENNIAL
CAMP, LAYDOWN, PILOT AREA		RAIL	

Kinosis Facilities Map

- K1A is currently shut-in



Annual Operational Rates vs Design





Section 9 – Historical and Upcoming Activities

Suspension and Abandonment Activity

Project Area	Development Area	Existing Pad	Suspension	Winndown	Abandonments
Long Lake	Long Lake	LL-001			none
		LL-002NE			none
		LL-002SE	02P08 & 02S09 D13 Surface Suspended	Inactive; evaluating ESP replacements	none
		LL-003			none
		LL-004	04S02 D13 Surface Suspended		none
		LL-005			none
		LL-006N			none
		LL-006W			none
		LL-007E			none
		LL-007N			none
		LL-008			none
		LL-009NE		1 active well; evaluating ESP replacement	none
		LL-009W			none
		LL-010N			none
		LL-010W			none
		LL-011			none
		LL-012			none
		LL-013			none
	LL-014/15E			none	
	LL-014N			none	
	LL-015S			none	
	LLSW	LL-016S			none
		LL-016W			none
		LL-017			none
LL-018N				none	
Kinosis	LL-018W			none	
	K1A-A			none	
	K1A-B			none	
	K1A-C			none	
		K1A-D		none	

- 1F2/10-32-083-03W4 Suspended at Kinosis

- Lessons

- Developed and implemented Covid-19 pandemic response plans for Long Lake site and Calgary office
- Developed field restart and operating strategy for extreme low-oil price environment
- Revised pipeline monitoring program after stress corrosion cracking discovered

- Successes

- Achieved record production from Long Lake in early-2020, prior to Covid-19 impacts
- Successfully executed plant and field turnaround in May & June
- Successfully executed field restart at reduced rates, and later ramp-up as pricing improved

- Failures

- Produced emulsion pipeline stress corrosion cracking discovered after field restart
 - Cracked sections were replaced and inspected
 - Findings and inspection results were provided to AER
 - Repaired pipelines were restarted in September 2020

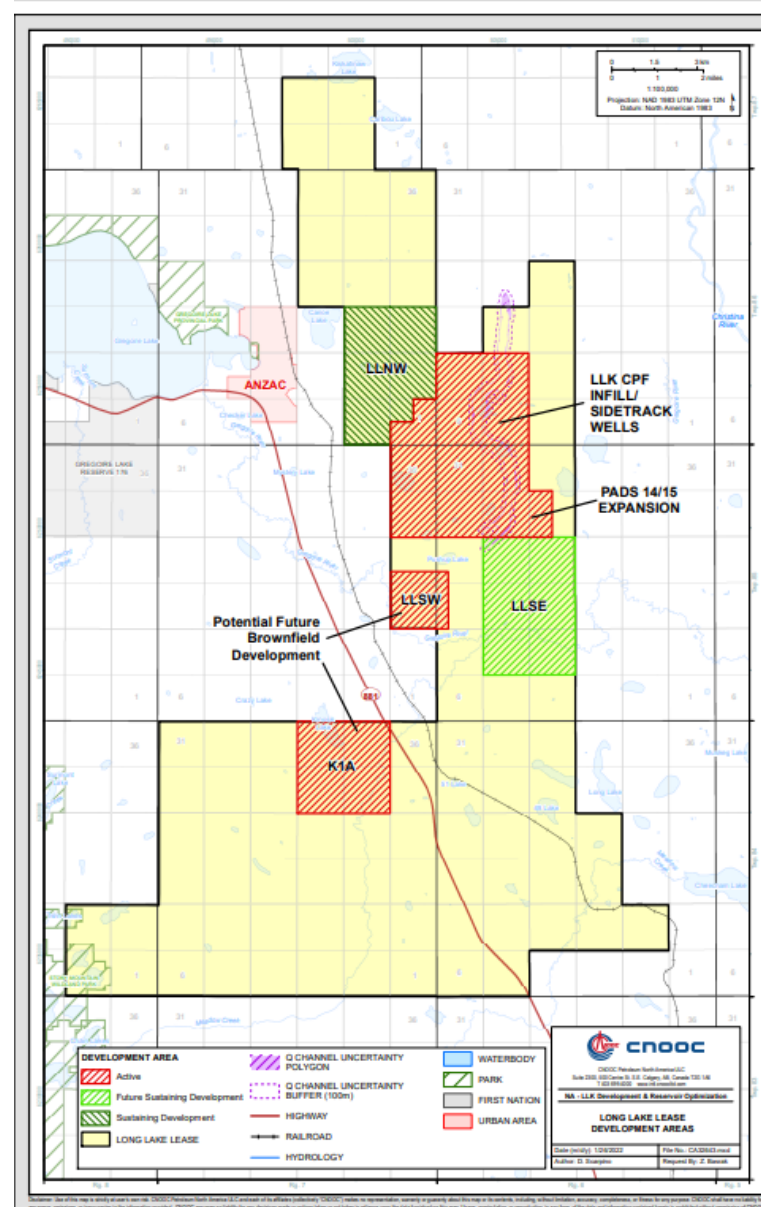
- Pilots

- None

- Major Technical Innovations

- None

Planned Development - Next 5 years





Section 10 – Regulatory and Operational Changes

Application No.	Registered	Request	Approved
1928745	27-May-20	Modification of circulation phase Maximum Operating Pressure for Long Lake South West Pads 16, 17, and 18.	Sept 29, 2020
1929041	2-Jul-20	Request for Extension to Upgrader 2 Construction Start Date	Jul. 14, 2020
1929071	6-Jul-20	Pads 2SE and 9NE Winddown	Aug, 10, 2020
1929863	5-Oct-20	Modification of Maximum Operating Pressure (MOP) Long Lake Pads 14 and 15	Mar. 19, 2021

- Successful major plant turnaround from May to June 2020
- Completed construction of Long Lake South West (LLSW) sustaining pads



Section 11 – Compliance History

Reportable Incidents Summary



Incident Type	Reference #	Date	Approval/Directive	Description	Corrective Actions/Follow-up
SCVF	Submission ID 2041849	January 9, 2020	ID 2003-01	Non-Serious surface casing vent flow (SCVF) detected from testing on well 06S11 (Licence No. 0327185).	Testing will be performed to meet requirements of Directive 087.
Casing Failure	Submission ID 2048719	February 26, 2020	ID 2003-01	Hole in the casing on well 104/09-28-085-06W4/00 was identified while work was being done to resolve a packer issue.	An extension was received and repair was completed on August 11, 2020.
Spill	FIS 20201573	July 5, 2020	EPEA	Release of ~ 0.02 m ³ of emulsion due to pinhole leak on the Pad 6 emulsion flowline; contained within lease boundary. In relation to this release, the AER visited site on July 15 to perform a pipeline operations inspection, which resulted in four (4) Satisfactory inspection report results.	Spill impacted area was immediately cleaned up. Final release report to be submitted Q3 2021.
Spill	FIS 20202173	September 13, 2020	EPEA	Release of 0.4 m ³ from a vac truck hose which split while flushing pad 6 emulsion pipeline.	Spill impacted area was immediately cleaned-up. Additional remediation activities underway.
Spill	FIS 20202702	November 18, 2020	EPEA	Release of 0.023 m ³ of methanol during transfer to tank due to a passing butterfly valve off the pump discharge; contained on lease.	Spill impacted area was satisfactorily cleaned-up. AER closed on March 10, 2021.
Spill	FIS 20202758	November 25, 2020	EPEA	Release of 0.015 m ³ of methanol following transfer to bulk storage tank, when hose was disconnected; contained on lease.	Spill impacted area was satisfactorily cleaned-up. AER closed on April 6, 2021.
SCVF	Submission ID 2074152	December 3, 2020	ID 2003-01	Non-Serious surface casing vent flow (SCVF) detected from testing on well 06S04 (License 0327192).	Testing will be performed to meet requirements of Directive 087.
SCVF	Submission ID 2074188	December 3, 2020	ID 2003-01	Non-Serious surface casing vent flow (SCVF) detected from testing on well 07P02 (License 0327457).	Testing will be performed to meet requirements of Directive 087.
Spill	FIS 20202943	December 21, 2020	EPEA	Release of 11.6 m ³ of emulsion from producer 8 on Pad 11. A valve nearest the emulsion header was passing, allowing emulsion access to the open drain. Majority of release contained to the well pad and subzero temperatures froze emulsion in place. AER conducted an inspection of the spill site on December 22 (ID 506474) which resulted in a Satisfactory inspection report.	Spill impacted area was cleaned up to the extent possible under frozen conditions. Final remediation cleanup was completed in April 2021. Final report submitted May 21, 2021.

Voluntary Self Disclosures Summary

ID	Voluntary Self Disclosure	Status
11018	<p>On May 12, 2020, a VSD was submitted for the failure to submit a repair or replacement plan within 30 days, for a loss of data at the 102/2-32-085-06W4M control observation well associated with the Q Channel Groundwater Management Plan, as required by Clause 26 of the Scheme Approval (No. 9485CCC). The AER accepted the VSD with the condition that CNOOC continues to communicate on progress and provided an update on the status of the VSD to the AER by July 31, 2020.</p>	<p>Successfully re-established communication with the subject well as of July 5, 2020. An update was provided to the AER on July 15, 2020.</p>
11089	<p>On September 22, 2020, CPNA submitted a VSD indicating that 2 wells were not operating in compliance with Scheme Approval 9485, as amended. The Pads 14/15 development was approved based on a 100 m offset from the nearest SAGD well pair to any interpreted caprock fault. CPNA acquired a 4D seismic survey over the Pads 14/15 area and reprocessed its existing 3D seismic survey data which resulted in a data set that was of superior quality. This resulted in a revised interpretation that indicates that sections of the 14P01 and 15P03 wells may be within 75 m of the caprock fault.</p>	<p>CPNA was required to provide an update by December 31, 2020, once amendment application for additional well pairs and removal of 100 m setback was submitted. Based on revised application submission timing and as per CPNA's request, AER issued a revised deadline of September 30, 2021. CPNA is targeting application submission by end of Q2 2021.</p>

Event Type	Approval/ Directive	AER FIS #	Date	Description	Corrective Actions
Industrial Run-off	EPEA	FIS 20202039	August 19, 2020	Failure to sample industrial run-off due to leaking culverts	Repaired/replaced non-functioning valves, and conduct inspections of emergency release culverts on regular rounds to prevent a future occurrence.
		FIS 20202423	October 13, 2020	Uncontrolled release of surface water overflow from Pad 4 moat	Weekly surveys of pad moat capacity conducted and designated personnel to monitor water level in the moats during heavy precipitation events and pump off if required
		FIS 20210642	July 2020	Failure to have industrial run-off samples analyzed by a laboratory (field-screened instead)	Sampling map was created to clearly identify areas requiring lab sampling and/or field screening, and signage installed at all valve discharge points listing requirements. Procedures and field screening forms updated and an operator training course for annual review. Distribution list created to ensure personnel are notified of any change in sampling requirements.
Air Emissions	EPEA	FIS 20200082	January 10, 2020	Multi-tank venting from deoiled tanks	Reported as per CPNA's Venting Reporting Protocol at that time. CPNA continues to address venting incidents by identifying root causes and implementing corrective actions to prevent future occurrences.
		FIS 20200191	January 17, 2020	Multi-tank venting from deoiled tanks	
		FIS 20202032	August 31, 2020	Long Lake CEMS availability less than required 90% for month of July	The purge blower on the CEMS analyzer has been replaced and procedural updates evaluated.
	Air Monitoring Directive (2016)	FIS 20202397	October 9, 2020	Failure to submit RATA testing reports with required timeframe	Requirements reviewed and compliance tasks have been added to compliance tool for automatic notifications and tracking.
Water Sources	Water Act	FIS 20202918	January 20, 2020	Water Act Licence 235895-02-00 pressure transducer data loss	The pressure transducer was replaced. CPNA will continue to monitor the pressure transducer during quarterly field data collection program to ensure it's functioning properly.



Section 12 – Future Plans

2021 Planned Activity

- LLSW startup in April 2021
- Completed installation of the Lime Sludge Centrifuge and commenced commissioning
- Commence construction of K1A replacement pipelines
- Commence construction of new Long Lake disposal pipeline
- Continued to evaluate modifications to current Upgrader design to increase product flexibility and improve efficiency, and assess schedule options for Upgrader restart

Future applications to be submitted for planned development

- Additional well pairs at Pads 14 and 15
- Long Lake infill/sidetrack wells
- LLNW sustaining development
- Disposal line replacement

A wide-angle photograph of an industrial refinery or chemical plant at night. The scene is illuminated by numerous bright yellow lights, creating a high-contrast scene against the dark blue night sky. In the center, two tall, cylindrical distillation columns are brightly lit, with a network of pipes and walkways surrounding them. To the right, a tall, slender distillation column stands out against the sky. In the foreground, a complex network of metal walkways and pipes stretches across the frame. The overall atmosphere is one of industrial activity and scale.

THANK YOU